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HALBERT P. GILLETTE, President and Editor
E. S. GILLETTE, Secretary

R. W. HUME, Vice-President
C. T. MURRAY, Managing Editor

Cleveland Office, 814 Union Mortgage Bldg.: E. C. KELLY, Manager
New York Office, 415 Lexington Avenue: ERWIN T. EYLER, Eastern Manager

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Why Make the Construction Industry a Hard Times Goat?

Once again it is proposed that public works expenditures be curtailed in ordinary times and expanded in bad times, so as to aid in ironing out the corrugations of the business cycle curve. This time the suggestion comes from Lawrence W. Wallace, Secretary of the American Engineering Council, in a paper read before the Academy of Political Science.

It is bad enough when such suggestions come from political economists, but we have been so long accustomed to see them try to solve economic problems without qualification of the factors that we feel no surprise at anything they say. But it is really distressing to see a representative of an engineering organization adopt the reasoning methods of political economists and try to solve an economic problem without proper qualification.

Mr. Wallace says that the federal government spends 75 millions a year for roads and 60 for rivers and harbors, and that 28 millions a year have already been authorized for new buildings to be erected during the next six years. This totals 163 millions a year, and he adds that the states spent between 300 and 500 millions for public works in 1925, during which year the total private and public expenditures for construction were 5,000 millions.

Mr. Wallace reasons thus:

"The Federal Government has no control over the expenditures of the states. It is believed, however, that, if the Federal Government should set an example of utilizing its expenditures for public works construction as a means of leveling the business cycle, the several states and municipalities would in time do likewise. Certainly if an appreciable amount of federal, state and municipal expenditures for public works construction were taken off the top of a boom and placed in the trough of a depression, it would materially alleviate the serious consequences of a business depression. Such a procedure would be far more sensible and wholesome in its influences than unemployment doles, or unemployment insurance, or bread lines. Such a procedure would enable public works of every kind to be constructed at a lower cost, because in periods of depression price levels are lower than in boom times."

The annual income of the American people is about 90,000 millions of dollars. The entire construction industry, public and private, is less than 10 per cent of this total, and that part controlled by the public (the part called public works) represents barely 3 per cent of the 90,000 millions.

During a general business slump, production, other than farming, falls off 20 per cent or more. Hence to reason that such a condition could be remedied by expanding public works during a business slump is akin to reasoning that the heat from the moon aids the growth of crops.

It is true, of course, that the brave example of one officer may put heart into thousands of privates. Hence the sound reason for not curtailing the public works during a business slump, for such slumps are in large measure due to fear that often amounts to panic. It may even be wise to expand public works during hard times, for the purpose of restoring general confidence. But no one who has weighed the statistics of public works expenditures against the total income of the American people could find in such a weighing any evidence that the hair on the end of the dog's tail is competent to wag the dog.

Furthermore it is yet to be proved that public works curtailed during good times and expanded during hard times would result in lower unit costs. In fact we feel safe in predicting that any careful study of the matter would disclose a great increase in unit costs if public work were done in this manner. It must be remembered that in America we perform most of our construction work with the aid of machinery, and that the smaller the percentage of time that such machinery is kept busy the higher the unit costs of construction.

They who speak of public works as if the "works" are akin to the building of the Egyptian pyramids by gangs of men working with primative tools and easily trained to the work, speak of what does not exist here. Construction in America is a machine job for skilled men guided by executives and engineers. Shall a large part of such a staff sit idle waiting for hard times, that they may then work a little while and thus bring about better times?

Please let us hear no more—at least from engineers—of curtailing public works in good times in order to eradicate the evil of bad times by expanding public works expenditures. But if we must hear more, let the speakers produce comparative data that we may judge the economy of such a plan. The burden of proof surely lies upon these innovators.

Dirt Street Maintenance

How Rhode Island City Uses Asphaltic Surfacing Material

By E. E. DURFEE
City Engineer and Highway Surveyor, Cranston, R. I.

Dirt roads in the country district of the City of Cranston, R. I., have been maintained for the past two years by the use of an asphaltic surfacing material containing 55 per cent of asphalt. The cost of upkeep has been reduced by the following method: The roads were first scraped with an ordinary road machine, all unevenness being taken out and the road properly crowned before the surfacing material was applied. The oil was applied by a pressure distributor at the rate of ½ gal. per sq. yd. Due to the soft condition of the road after scraping, it was not necessary to cover with sand except in spots where the road material was hard. These places were given 48 hours to absorb the oil, after which they were given a light coat of sand.

Scraping Roads Preparatory to Application of Oil

In about three months, there developed a number of pot holes, where the oil had been picked up by passing teams, or where, due to the condition of the road, the oil failed to stick. These pot holes were patched with a mixture of sand and Texaco liquid asphalt No. 1, which contains approximately 65 per cent of asphalt. By means of a small concrete mixer, the sand was mixed with enough oil to give it a dark brown color. This patching material was just thrown into the holes, and soon compacted under the traffic so that no traces of the patches could be found.

The spring season of the second year, we found the roads in rather bad condition, due to the frost and winter travel. There was, however, a considerable amount of oiled surface still existing but we found no difficulty in again scraping and re-shaping with the road machine. This mixture of dirt and oil, after being scraped, left a splendid surface for the new application. In some places there showed from 1 to 2 in. of this dirt and asphaltic surfacing material mixture where the road machine had pulled it into holes or ruts. The roads were treated with Texaco No. 55 surfacing material as before. Very little difficulty was experienced the second year with pot holes.

Dirt Road After Scraping, and Ready for Third Annual Treatment With Texaco Surfacing Material

The roads have all been scraped this spring, ready for the third application of oil. From all appearances, we will have a mat of sufficient thickness to withstand any traffic the roads will be called upon to carry.

Due to the hard appearance of the surface at this time, we contemplate using Texaco liquid asphalt, a heavier material than No. 55 surfacing material, and covering it with sand for this season.

The opening of the new reservoir by the Providence Water Supply Board at the end of one of these roads has increased the auto traffic by thousands, yet very little difficulty was found in keeping the road in condition. A section of this road left untreated has gone to pieces under the heavy automobile traffic.

Tennessee Legislature Authorizes $65,000,000 of Bond Issues.—The general assembly of 1927 of Tennessee authorized bond issues totaling $65,000,000. These included $16,500,000 to take over the county highway bonds, $22,825,000 for roads, $11,806,000 for bridges, $9,780,000 for schoolhouses and courthouses and $4,371,000 for waterworks and sewers of various municipalities.

Traffic Control by Electric Signal Lights

System at Washington, D.C., Described in Paper Presented Before American Society of Civil Engineers

By M. O. ELDRIDGE
Director of Traffic, District of Columbia, Washington, D. C.

One of the more difficult traffic centers of Washington, D. C., is Scott Circle (Fig. 1). The situation here is complicated because it is the intersection of six streets (three directions), the main traffic being north and south in Sixteenth Street. There is a considerable rotary as well as through movement, but signal lights have fairly well succeeded in solving the difficulties, as shown in Fig. 1. The essential features of this plan are the division of the circular street with an inner zone for through north and south traffic and an outer zone for rotary traffic; and the treatment of both diagonal avenues simultaneously as cross-streets.

Co-Ordinated System Improvements.—If costly congestion is to be relieved the flow of traffic must be rapid. Rapidity of traffic is extremely hazardous unless it can be smoothly conducted with absolute safety at intersecting streets. Synchronized traffic signals, whereby all lights on a main artery of travel show "green" for a given period, then "red," were originally thought to produce the best results. Modern practice, however, has a tendency to abandon this form of control in favor of the progressive or co-ordinated system whereby a vehicle traveling on a main street gets a change of signal at each cross street and is then able to proceed the full length of the controlled section at a predetermined rate of speed without a stop.

Shorter Timing Gives Even Flow.—Under the old synchronized system the timing on the main street was necessarily long in order that traffic might move as far as possible before a change of signals brought it to a halt. In congested business districts this tended to cause traffic jams in the cross streets where vehicles were necessarily stopped for 1½ and 2½ min. on each signal change, with the result that each cross street became completely filled. When the green light appeared there were too many vehicles in the block to clear the intersection before the red light came on again. In fact, it was not unusual for two or three changes of signals to be required to clear a given vehicle from a cross-town block.

The progressive and co-ordinated systems are operated on a much shorter timing, 30 to 45 sec. usually being sufficient. This results in fewer vehicles being caught in a block when the red light shows and more space being provided for parking vehicles to pull out from, or for others to get into, the curb. It also permits a smaller number of vehicles to clear the intersection on one signal change.

Timing Set to Desired Speed.—With the synchronized system no speed control was possible except by motorcycle police, whereas with this more modern type the timing can be set to permit any desired speed.

In Washington, a driver can run 12,000 ft. on Sixteenth Street where the traffic is comparable with that of Fifth Avenue, New York, in 7 min. at approximately 20 miles per hour. This speed can be varied by the simple expedient of changing the timing so that either a fast or slower speed will be necessary. It is obvious that in order to get through the controlled sections, the speed must be maintained in conformity with the timing of the signals, otherwise the driver will be stopped at each intersection. Fig. 2 shows the operation of the progressive system as applied to a portion of Sixteenth Street, in Washington.

Easy to Change Old System.—For those cities already equipped with synchronized systems it might be of interest to note that such systems are easily changed to the progressive type of operation at no expense other than a few hours' labor. This can best be done at night when traffic is lightest. It is accomplished simply by reversing the red and green lenses on alternate signals, or on alternate groups of signals, so that the interval and length of run may harmonize with the desired average speed. In Washington, where the blocks are 250 to 1,000 ft. long, it was found necessary to group the lights singly, or in sets of two or of three intersections, depending on the length of the blocks.

A traffic officer is needed to control the intersection at which the change is being made only while the lenses are being shifted; this officer can accompany the workmen from street to street until the work is completed. After the change is effected, the lights should be carefully watched, and the controlled section should be tested by an official car for a few days until proper timing and any additional signal-lens changes have been determined. When all is operating in a satisfactory manner, the lenses that have been changed should be replaced and the wire terminals in the signals shifted accordingly, so that the colors on all signals will be in the same relative positions, as an aid to color-blind drivers.

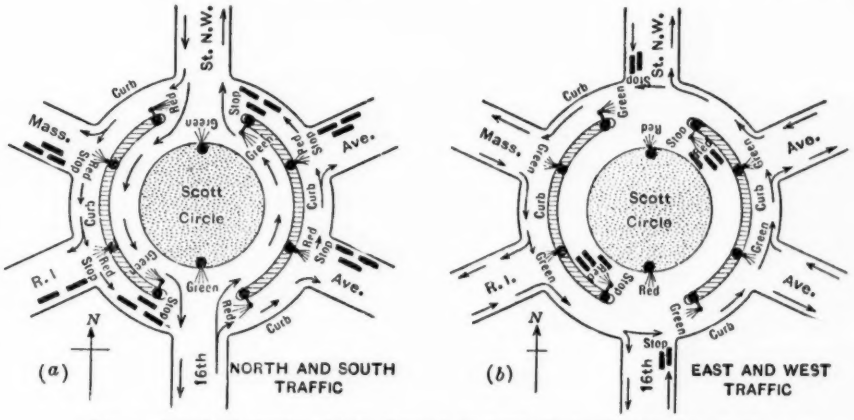


Fig. 1—Detail of Traffic Lights; Control in Scott Circle, Washington, D. C.

Amber Lights a Matter for Study.—There is much difference of opinion as regards the use of an amber light in addition to the red and green lights. Experience in Washington, thus far, has led to the conclusion that the amber light is necessary in order that a maximum of safety may be afforded to the pedestrian and the intersection cleared of moving traffic. It is apparent, however, that the use of the amber light is a subject that merits the careful consideration of all traffic engineers.

The amber signal is not a "stop" signal; neither is it a "go" signal. Its purpose is to warn moving traffic that the "go" period is almost over and that a "stop" signal will be flashed in 5 sec. At a speed of 20 miles per hour, drivers who are within 50 or 60 ft. of an intersection have ample time to continue crossing the intersection and be out of the way before the direction of the traffic changes, and drivers who are farther back from the cross-walk have plenty of time to bring their cars to a gradual stop without suddenly jamming their brakes, and possibly causing the

following vehicle to collide with them.

No Need of Forewarning for "Go" Signal.—On the other hand, the use of the amber light following the "red" is not justified, because standing traffic has no need of a warning that the signal is about to change. Experience has shown that where this warning is given by flashing the amber light after a red light, standing traffic is likely to anticipate the green light and start too soon, thus endangering the vehicles that have not finished clearing the intersection.

The ideal traffic cycle might possibly consist of a green light displayed for a predetermined number of seconds, followed by an amber light displayed for 5 sec., followed by a red light displayed for the desired length of time, followed by a green light, etc. Such a cycle would afford ample protection to pedestrians, as it would provide time for those walking in a green light zone to reach a point of safety, while the red signal on the intersecting street continued to hold traffic.

The use of green, red, and amber (yellow) signals in Washington, is illustrated in Fig. 3 (*a*), (*b*), and (*c*).

Right and Left-Hand Turns.—There seems to be little uniformity in the method of making right and left-hand turns in different cities. Right-hand turns are always dangerous, because vehicles are obliged to pass over two cross-walks and necessarily cut through the line of pedestrians walking with the proper signal. In Washington, all right turns are made against the green light, in order that the turning vehicles will not encounter a line of moving traffic [Fig. 3 (*d*)].

Left turns are less dangerous, because they can be controlled and the vehicle only passes over one cross-walk and at a time when no pedestrian has a right to be there. They should if possible be eliminated, however, at intersections where two-way traffic is permitted on both streets, as under this condition they tend to cause congestion.

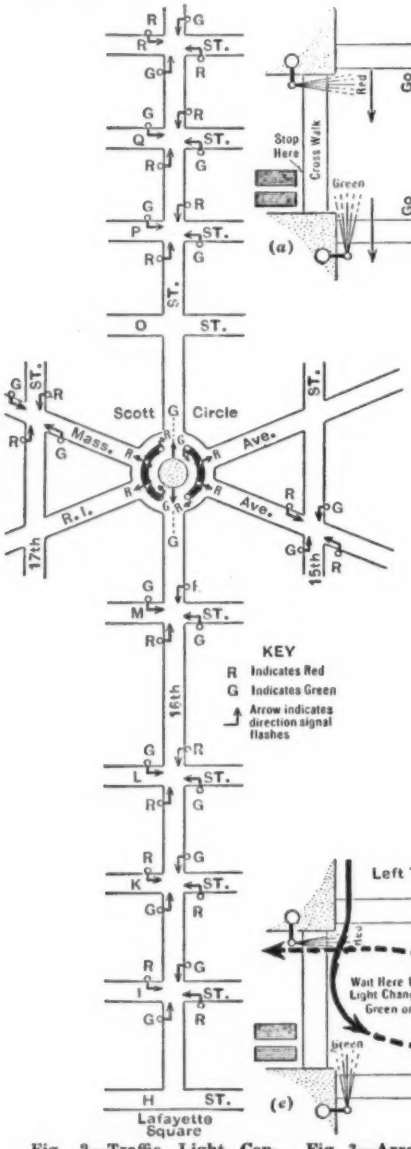


Fig. 2—Traffic Light Control, 16th St., and Massachusetts Ave., Washington

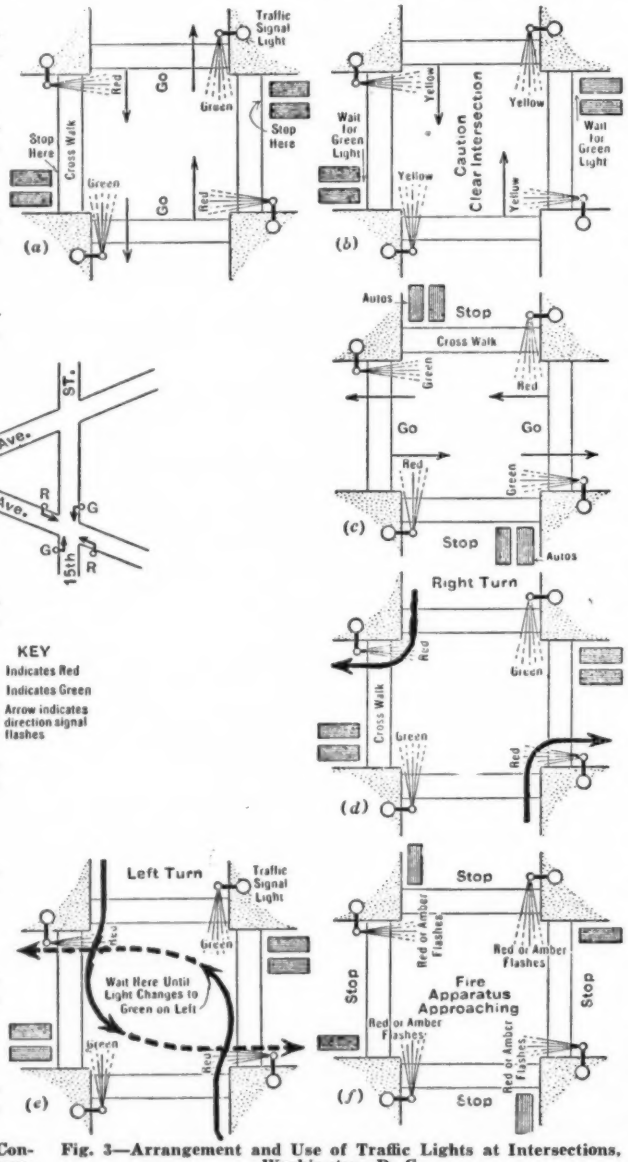


Fig. 3—Arrangement and Use of Traffic Lights at Intersections, Washington, D. C.

The driver desiring to make a left turn in Washington [Fig. 3 (*c*)] pulls into the intersecting street when the light confronting him is green, keeping as far to the right as possible. He then stops alongside the cross-walk in such a manner as to block traffic on the intersecting street, leaving ample space for through traffic to pass on his left. When the signal changes, the turn is completed. This method of making the left turn on streets controlled by traffic lights has proven to be eminently satisfactory.

At points where a two-way street intersects a one-way street, the driver wishing to make a left-hand turn stops at the right-hand curb, just back of the cross-walk line, and when the signal changes to red, stopping through traffic on the two-way street, the turn is completed. Vehicles moving on the one-way street make the left-hand turn into the two-way street when running on a green signal.

Division Into Zones.—The signal system in Washington is divided into different zones, and the controlling apparatus in each zone is installed in a conveniently located fire engine house. At one of these controlling points an operator is continually on duty to operate the fire signal in that zone, and in case of emergency to throw the switch changing the control from automatic to manual, and then to operate the signal by the manual control while the emergency exists.

Signal Approach of Fire Apparatus.—The Washington fire signal consists of an amber and red light displayed simultaneously in all directions [Fig. 3 (*f*)]. This is a flashing signal operated at approximately 30 flashes per min., and all traffic is required to clear the intersections and to come to a standstill while the signal is on. The time that this signal is displayed depends on what fire apparatus is using the streets; it varies from 45 sec. to 3 min. The operators are furnished with a list of fire-alarm boxes, which call for a display of the signal, together with the time that the signal should be operated for each box. The Chief of the Fire Department reports that the use of this signal has been of great benefit to the movement of fire apparatus.

Electric traffic signals have come to stay. Their usefulness and efficiency have been clearly demonstrated, and there is no question that they are a vital factor in the reduction of traffic accidents.

76% of Water Pumped Accounted for at Dubuque, Ia.—According to the last annual report of J. W. McEvoy, superintendent of Water Works of Dubuque, Ia., 67 per cent of the water pumped last year was salable, 33 per cent brought no revenue, 76 per cent was accounted for and 9 per cent was lost through known sources.

Water Works Superintendents and State Boards of Health

Some Ideas on Their Relationship Given in Paper Presented at Annual Convention of Southeastern Water and Light Association

By H. A. KROEGE

Director Bureau of Sanitary Engineering, Mississippi State Board of Health

What relationships do exist between waterworks superintendents and state boards of health are generally looked after on the part of the state board of health by the sanitary engineering division of that body. With the increase in knowledge of preventive medicine and the relationship between water supplies and certain diseases that can be transmitted by water the need of technical personnel with engineering training in state boards of health became apparent. The result has been that practically every state in the union has today such an organization, generally a part of the state board of health organization, one of the chief duties of which is to supervise the sanitary quality of all public water supplies in the respective states. This immediately brings a state organization—in this case we will call it the state board of health—in close relation with the superintendents of the waterworks.

Primary Aims.—In order to have a clear understanding of the relationship between these two groups, I think it well that we understand the primary aims or objectives of each group. Stating it briefly, the state board of health is interested primarily in a safe and adequate water supply for domestic consumption. The superintendent must provide not only water for domestic consumption but for fire protection and industrial purposes. The order of importance of these varies with the individual superintendent and the city officials, between whom at times there is a difference of opinion, while the state board of health, which must act strictly in the interests of the public health, must place the safety of the water supply ahead of all other considerations. I do not mean by this that we should be arbitrary about this matter, but it does call up one point where the relationships between the two groups should be well understood and which if the proper cooperation exists, would bring about the greatest good to all parties concerned.

It might be well to illustrate this point with one or two observations. A city of about 8,000 population had a bad fire and after fighting the fire about twelve hours the supply became so low the wells, which were not being pumped, could not keep up with the demand of the fire department. Immediately after the fire there was considerable agitation for a remedy to prevent a similar occurrence. Apparently the first thought that came to the minds of the water commissioners of the city was the installation of an intake to the river that flowed near the water plant, to be connected with the service pumps with one gate valve on the line. The superintendent approved the plan and was about to commence with the work when the state board of health learned of this proposed action. Objections were raised and a conference requested with the water commission and the superintendent. This was at first refused and later granted. At the meeting the board of health representative refused to approve the proposed connection and recommended the construction of additional storage capacity, the pumping of the flowing wells to increase their flow and if necessary, the installation of additional wells. Strenuous objections were raised by the commission because of the cost of these improvements while the board of health representative was equally as positive in pointing out the dangers and the commissioners' responsibility of mixing a polluted river water with a safe deep well supply for the sake of fire protection when the necessary fire protection could be had without this danger. Throughout the discussion the superintendent, who it appeared should have known better and could have been of considerable assistance in a satisfactory settlement of the matter, advocated the river intake. It is needless to say the question was not settled at that time with the exception that it was agreed to put off the construction of the intake pending a test to be made to ascertain how much the flow of the wells could be increased by pumping. In the meantime an insurance rating bureau in rating the city included in their recommendations the three points recommended by the state board of health. It is hardly necessary to say that these ideas were promptly carried out, not however, because the state board of health had recommended them, but primarily because of the insurance rating bureau. Nevertheless, the river intake was never installed.

A Dangerous Cross Connection.—In another city a small stream passes directly through its center. Two main lines lead out from the waterworks plant, one for each half of the city. An industrial plant on the opposite side of the stream from the waterworks had a private supply secured from the narrow stream at a point almost directly opposite from the city sewer outlet. Examinations made of water collected on several occasions at various points in the city on both sides of the stream showed that the samples of water taken on the side of the river on which the industrial plant was located were contaminated, while those from the other side were not. An investigation was made to locate, if possible, the trouble. The superintendent of the waterworks was very cooperative and mentioned the existence of some kind of a cross connection between the city line on that side of the river and the private supply of the industrial plant. With his assistance tests were made on this connection and on two out of three tests water was found leaking from the mill supply side of the gate valve into the city mains. The superintendent lost no time in severing this connection and over a period of several years following, he successfully withstood all attempts to have the connection restored. At the same time recommendations were made to the manager of the industrial plant, showing how he could still make use of the city supply without the necessity of a dangerous cross connection.

In the foregoing, I have attempted to bring out two kinds of attitude that a superintendent can display relative to his duties and obligations to the community which he serves. Also how he can obstruct or aid the efforts of the state board of health, which should always be aimed at the greatest good for the largest number of people.

Benefits of Close Cooperation.—Close cooperation between the superintendents and the state board of health can be mutually beneficial. What one does should be of help to the other. The state board of health can help the superintendent secure many much needed improvements by pressing the matter and backing up his recommendations to the city officials. On the other hand the superintendent can likewise aid the state board of health with the city officials by lending his approval and support to their efforts to secure changes or improvements needed.

Often a difference of opinion may arise between a state board of health representative and a superintendent as to the best means of correcting a sanitary defect of a water supply. This need not lead to an argument that

would do neither side any good and perhaps do harm to otherwise pleasant relations existing between the two. Generally speaking, many superintendents may not be so well versed in the sanitary principles relating to water supplies while the engineering personnel of the state board of health should be or should not be holding their jobs. On the other hand the latter can not possibly have an intimate knowledge of all details connected with each individual supply while the individual superintendent should know his own plant. With a clear understanding of these points it is believed a satisfactory solution could be found for any such difference of opinion. It is not the duty of the state board of health to be dictatorial about methods of correcting a defect so long as the defect is corrected without opening up another defect. In other words, if a defect exists, it should be corrected, and within reasonable limits the means of correcting the defect should be left up to the superintendent.

Again the occasion arises wherein the superintendent can not see the necessity of making a correction, believing a defect does not exist or that the point in question is a matter of no importance. Such a case calls for the representative of the board of health to exhaust all means to convince the superintendent of the point at issue and endeavor to secure his cooperation before going over his head. Only after failure to secure his cooperation should the matter be taken to the city officials and then it should be so presented as to cast no reflection, if possible, on the superintendent. This point in our relationship is one of utmost importance, since considerable harm can be caused by the tactless handling of such a situation. It is regrettable that such situations need arise, as they are caused primarily by the lack of a proper understanding on the part of a superintendent, of the relationship of the state board of health and himself. Such a situation creates an antagonistic feeling, generally on the part of the superintendent, that does nobody any good but does injure the feeling of helpfulness and cooperation that should exist between the individuals of the two groups.

How the State Board Can Aid the Superintendent.—The state board of health should be in a position to aid and advise a superintendent on all matters relating to the chemical, physical, and bacteriological quality of his water. They should be able to help him in some of his operating problems and should be able to act as a newsgatherer of problems affecting one man's supply in one part of a state that could be helpful to a man in another part. They should have a knowledge of the qualities of water found in the various parts of a state so as to be of assistance in the development of new supplies. In fact the state board of health should be in a position to act as a clearing house for all information concerning the problems of water supplies so as to be able to help or advise when such is requested. To do this, however, the cooperation of the individual superintendents is needed to forward any information on any problem they have met and solved to the board of health that they may be able to pass it on to whoever might be seeking information on a similar problem.

You will notice that throughout this paper the position of the superintendent has been stressed and very little reference has been made to municipal officials. The superintendent is the man on the firing line and consequently is the man to work with. He is the man usually held responsible by the individual citizen for the condition of the water and he is the man to whom the complaints are made when someone feels the urge to make a kick. His position is sometimes an unpleasant one, though it is through no fault of his own that it becomes so. Very often conditions arise which are the source of numerous complaints concerning the physical or chemical qualities of the water or the complaint of "red worms" in the water, which happen regularly in the summer months in Mississippi, the causes of which the superintendent may not be familiar with. The state board of health should be his salvation and it is generally the wise superintendent that will not hesitate to call on them. Such things bring the two groups together and generally promotes a better understanding between the individual superintendent and the state board of health. It is the belief of the writer, based on knowledge gained in this state, that the state board of health should maintain a closer relationship with the superintendent of the plant than the city officials. The waterworks is the superintendent's particular job and any improvements that should be made must be made through him and the city officials serve chiefly as a means to the end by providing the necessary authority or finances to proceed with the improvement.

The question of relationship between waterworks superintendents and state boards of health is one of importance to both groups. An improper understanding of these relationships can lead to useless controversies that very often serve of no value to the basic cause of the controversy. On the other hand a proper understanding can lead to a cooperative spirit that would be mutually beneficial to the superintendent in the carrying on of his duties, to the state board of health in the discharge of their responsibilities, with the public receiving the benefits that would accrue.

Reducing Residual Hardness of Water—Very good results have been reported from Columbus, O. from the use of sodium aluminate in connection with lime-soda softening as a means of reducing the residual hardness.

Meter Maintenance

Methods in California Outlined in Paper Before California Section American Water Works Association

By J. H. FAGG
District Manager, Pacific Gas & Electric Co., Stockton, Calif.

For the purpose of this report a survey was made by means of a questionnaire returned by 28 water companies in California, whose services were metered 80 per cent or over, and involving a total of approximately 640,000 services.

Of these twenty-eight, thirteen plants were municipally operated, and fifteen operated by private companies.

The questionnaire produced the following information:

1. Fifteen companies check all new meters for accuracy upon receipt.
2. Twenty companies use the round reading dials, and the cubic foot, with one exception, is the unit of measurement.
3. Only five are continuing the use of compound meters.
4. Fifteen of the twenty-eight are using batteries of small meters on the larger services.
5. But three of the companies test their meters periodically: one on a two-year schedule, one on a three-year schedule and one every four or five years. Also two remove their meters for test and overhauling after one complete revolution of the dial.
6. Practically all of the companies use the concrete meter box and set meters just inside of curb line where mains are carried in the street.
7. Eleven of those reporting are employing check valves to prevent hot water damage and bill consumers the cost of repairing the damage caused by hot water.

In analyzing the return on the questionnaire it appears that most of the companies realize the importance of testing new meters when received, and from the tone of some of the statements it is believed that it will soon be general practice to test all meters periodically.

The round reading registers are giving the best satisfaction, as they will operate over longer periods than will the straight reader.

The use of compound meters is being discontinued rapidly by nearly all of the companies and the use of batteries of small meters on large services is becoming popular with most water works men.

A very small percentage of those reporting are making a practice of testing meters in the field, and they have equipped their shops with standard test tables of standard manufacture and other necessary facilities for proper handling of meter repairs.

Water Softening by Zeolite—There are now two municipal water supplies in this country softened by zeolite. One is the plant at McKees Rocks, Pa., operated by the Ohio Valley Water Co., and the other is at Coopersville, Ohio, operated by the municipality. Both of these plants have about 4.5 m. g. d. capacity.

20 Years Progress in City Planning

Excerpts from the President's Address, Nineteenth National Conference on City Planning, Washington, D. C., from National Municipal Review

By JOHN NOLEN

Town and City Planner, Cambridge, Massachusetts

In order to measure the character and extent of twenty years' progress in city planning, we must attempt to set down some of the existing conditions in American municipalities in 1906 and 1907, especially those conditions which influenced the rise and development of city planning. Here are some of the main facts:

About twenty years ago there were 135 cities of 30,000 or more in the United States, and there were 19,050,921 persons living in these cities. Today there are 248 cities, and 39,981,105 population (figures are from 1924 statistics), so that there has been an increase of 113 cities (of 30,000 or more) and 20,930,184 population. The query here, which we must consider later, is what influence has city planning had upon the distribution of this increased urban population of over twenty million.

The wealth of the United States was then one hundred billion dollars. It is now about four hundred billion dollars. This new wealth has made great changes in the character of cities. Has a proportional share of it been used for improvements based upon better city planning?

Progress in city planning depends upon the form and efficiency of city government. Twenty years ago the city commission idea had just been broached, and there were no "city manager plan" American cities. There are today more than 350 American cities employing the city manager plan, credit for which is due largely to the National Municipal League. Advance in city planning is undoubtedly directly dependent upon the efficiency, success and ideals of city government.

1904—the Shame of Our Cities.—It is difficult to present briefly an impression of the general conditions existing in American cities twenty years ago, but even a few references may help. In 1904 Lincoln Steffens published his "Shame of the Cities," with chapters on graft and corruption in St. Louis, Minneapolis, Pittsburgh, Philadelphia, Chicago and New York; and in 1906, his volume on "The Struggle for Self-Government." About the same time appeared "The Battle with the Slum" by Jacob Riis, and other books and articles dealing with municipal reform. City government was at a low ebb, but an awakening was in sight, preparing the way for better local government and better planning. Charles Zueblin published "A Decade of Civic Development" in 1905, and the "American Municipal Progress" in 1916. These books of Lincoln Steffens, Jacob Riis, Professor Zueblin and others give a sufficient basis for recalling the general municipal conditions in American cities twenty years ago, and comparing them with the conditions of today.

During the years 1914-1918 the World War was fought. It influenced life profoundly, and left its permanent impress upon cities and the problems that we group under such terms as city planning or regional planning.

Skyscraper and Motor Car.—The most revolutionary factors, so far as American city life and city planning are concerned, are, however, still to be mentioned; namely, the building of the skyscraper and the bewildering increase in the manufacture and use of motor vehicles.

The coming of the skyscraper is generally attributed to the first decade of the twentieth century, the Flatiron Building in New York being erected in 1902, the Singer Building in 1908, the Metropolitan Life in 1909, and the Woolworth Building in 1913.

Some statistics and references, regarding motor vehicles follow. Their influence upon American city planning is almost beyond estimate.

In 1905 there were but 24,550 passenger cars produced, and 450 trucks.

In 1925 there were 3,839,302 passenger cars produced, and 497,452 trucks.

In 1905 there were only 77,400 passenger cars registered and 600 trucks.

In 1925 there were 17,512,638 passenger cars registered, and 2,441,709 trucks.

Twenty years ago the Ford car was unknown, the first being manufactured in 1908. On January 1, 1926, there were registered in the United States 8,164,275 Ford cars, exclusive of Ford trucks.

It is estimated that at the close of 1926 there was a total motor vehicle registration of 22,330,000.

No Planning Twenty Years Ago.—When we turn to city planning itself, what do we find twenty years ago? The answer is, almost nothing. With the exception of the McMillan plan for a comprehensive park system for Washington (1901), prepared by a distinguished group, Burnham's plan for San Francisco (1905), and a few tentative and unofficial efforts, no comprehensive city plans, as we think of them today, had been prepared. There were no city plan commissions; the idea of the civic survey was unknown, as was regional planning also; no zoning ordinances had been passed or even discussed; there was no National Conference on City Planning and no American City Planning Institute; no teaching of city planning in schools or colleges; and no books or other publications of note on this subject. Moreover, there was no interest in city planning among the people generally, except so far as it was beginning to express itself in a wider discussion of the "city beautiful" in connection with civic centers and parks and playgrounds.

Record of Progress, 1907-1927.—Stock taking is profitable, but in a subject like city planning it is difficult to make it really significant. We must set down not only facts but tendencies, and we must also endeavor to find the causes of both good and bad results, or of no results.

No statement is more important to emphasize and establish than that city planning or regional planning, to be of greatest value, in fact to justify the use of the term, should be comprehensive, related, and co-ordinated. But while planning should be comprehensive, related and co-ordinated, the improvements themselves must be carried out separately from time to time, in accordance with the general scheme. The test of progress, therefore, must be made in each subject, but the character of the improvement itself should be scrutinized to see whether it is an integral part of an orderly and organic plan. Such tests should be applied to plans for major streets, railroads and traction lines; for parks, playgrounds and other open spaces; for waterfronts, civic centers, housing, etc. The character and quality of these changes and improvements should be tested, first with regard to fitness and economy in accomplishing their purpose, and secondly, the way in which they have been done from the point of view of appearance, and a proper regard for the preservation or increase of amenities.

It is not feasible in a brief address to enumerate in any detail the progress made in city planning in two long and busy decades, nor is it called for. Annual reviews of great merit have been made regularly from year to year by the secretary and various members of the City Planning Conference, by Mrs. Henry V. Hubbard and others, and the detail record is an honorable one and worthy of further study. It would seem to be possible, however, to review briefly in a single address those main factors which mark the extent, character and quality of city planning progress.

What does the record of twenty years show?

The record shows that 157 cities have been planned, for most of which accompanying reports have been printed. These plans include cities in every state in the Union with the exception of Arkansas, Delaware, Idaho, Kentucky, Louisiana, Mississippi, Montana, Nevada, New Hampshire, North Dakota, Oklahoma, South Dakota, Utah, Vermont, Wyoming. The greatest number of plans were prepared for cities of 50,000 to 100,000 population. The number for other population groups is as follows:

Population	No. of Planned Cities
1,000,000 or more	2
500,000 to 1,000,000	8
250,000 to 500,000	12
100,000 to 250,000	22
50,000 to 100,000	36
25,000 to 50,000	28
10,000 to 25,000	25
5,000 to 10,000	12
2,500 to 5,000	6
Under 2,500	6

460 Zoned Cities.—Official zoning ordinances have been adopted by 460 cities, more than three times the number of cities for which comprehensive plans were prepared. One-half the urban population of the United States is now living in zoned cities. The principal facts with regard to zoned cities are as follows: All states have zoned cities except Arizona, Idaho, Kentucky, Mississippi, Montana, New Mexico, South Dakota, Vermont, West Virginia and Wyoming. There are 460 zoned cities, New York State leading with 77.

City planning commissions have been established in 390 cities. There are city planning commissions in every state with the exception of Arkansas, Idaho, Mississippi, Nevada, New Mexico and North Dakota. In Massachusetts, Pennsylvania, Ohio, California, Indiana and Kansas, state planning organizations in one form or another have been formed as federations of these city planning commissions.

During this period important city planning legislation has been passed and judicial decisions of great importance and influence rendered. The constitutionality of zoning has been upheld by the highest courts of California, New York, Arkansas, Illinois, Oregon, Rhode Island, Louisiana, Wisconsin, Massachusetts, Ohio, Minnesota and Kansas. The Supreme Court of the United States upheld zoning in an important decision recently in the Euclid Village case.

The National Conference on City Planning was organized in 1910, preceded by a preliminary meeting and exhibition at Washington in 1909. During that period annual sessions have been held without a break. A volume of proceedings has been published each year. Since 1907 city planning exhibitions have been held in many cities.

The American City Planning Institute was organized in 1917, to "study the science and advance the art of city planning." It has held seventeen useful sessions.

City planning publications of value in the form of books, magazines, pamphlets, reports and articles have appeared increasingly during the last two decades. The rate of progress that has been due in part to these publications. The publications of most permanent value covering the subject comprehensively are listed in the supplement to this address.

Special mention should be made of the publications of the Department of Commerce, prepared under the initiative and auspices of the secretary, Mr. Herbert Hoover, as follows: A Standard State Zoning Enabling Act, 1922 and 1926; A Proposed Standard City Planning Enabling Act, 1926; A City Planning Primer, 1927.

A great advance has been made in education in city planning in high schools, colleges and technical institutions.

Technical Groups Co-operate.—Progress in city planning depends upon the co-operation of the technical groups directly concerned with the physical planning; namely, engineers, architects and landscape architects. There has been a steady advance in such co-operation.

Another test of progress is the building of new towns and cities or the extension of cities by laying out important suburbs. These developments might be termed garden suburbs, garden cities, or satellite towns.

The scope and character of city planning itself has changed. The local survey and the collection of reliable data have become an essential part of good work. Plans and reports have been steadily improving. The list of topics included has been increased and the field has been widened to include regional, state and even national planning.

What forces are back of the last twenty years' progress of city planning? Great changes do not generally come without important reasons. It is worth while to ask, therefore, what influences are behind these changes in cities, from the city planning point of view, during the period under discussion. They may be summarized in this fashion: Increase in population and wealth of cities themselves; improvement in the forms of city government, especially city commissions and the city manager plan; improvement in the technique of city planning, resulting from professional courses; publications, conferences and discussions, notably those of technical planning organizations; the American City Planning Institute; the World War, which has left a permanent impress upon city planning both directly and indirectly; the mechanization of life, especially the skyscraper and the automobile; public opinion, influenced especially by newspapers, books and periodicals, chambers of commerce, men's luncheon clubs, women's organizations, the American Civic Association, the National Housing Association, the National Municipal League, and other national associations; the change in the point of view of realtors with regard to land and planning; and the work of local city planning commissions and of the National Conference on City Planning.

67,500 Tons of Mud at Waterworks

St. Louis Begins Removing Sediment Deposited in First Settling Basin

Approximately 67,500 tons, or 165,000,000 pounds of mud will be removed from a reservoir at the Chain of Rocks Waterworks of the St. Louis, Mo., water system, in the semi-annual cleaning of the settling basin, which receives the Mississippi river water for the first step in its purification.

The flood this year brought unusually muddy waters, also making it impossible to clean the first settling basin at the waterworks at the regular time in April, the mud deposit in the reservoir is greater than it has ever been before.

When the 30,000,000-gallon capacity basin was drained the sediment was within 6 inches of the top, although the basin is 23 feet deep in the center and 16 feet deep at the sides. Ordinarily when the settling basin is cleaned in November and April the mud sediment is about 5 feet deep. The high water covered the sewers this year and made it impossible to remove the mud in April.

Because of the vast amount of sediment in it the first settling basin, which is one of seven at the waterworks, has not been used recently and the chemically treated water has been passed through the conduits into the second settling basin where the chemical action precipitates the mud before the water passes into the other basins for further precipitation and finally into the filter plant.

About five or six weeks will be required to clean the reservoir, it is estimated.

The first settling basin is 670 feet long by 400 feet wide, and in the cleaning process men with horses and wagons enter the basin diluting the mud and hauling it to one side so that it can be pushed through the sewer which empties into the Mississippi.

In the new city water plant on the Missouri river the mud in the settling basins will be removed by a mechanical device which will keep them clean at all times, according to Water Commissioner Day.

Snow Removal in New York City

Methods Employed by Department of Street Cleaning Described in Paper Presented Before American Society of Civil Engineers

By ELMER C. GOODWIN

Examining Engineer, Department of Street Cleaning, New York, N. Y.

Of the difficult problems entrusted to city officials, authorities rank those of the Department of Street Cleaning and its snow removal work, second, the Police Department holding first rank.

The Department of Street Cleaning has to contend with forces, particularly during the winter season, with snow storms, gales, abnormal tides, and fogs, which cause frequent emergency conditions on land and water that render its work exceedingly difficult.

Speed is the main essential in snow removal and traffic is the overshadowing factor in preventing it. The temporary paralysis caused by a stagnant traffic creates a grave fire hazard. Upon the free movement of traffic depends the delivery of coal, foodstuffs, every form of merchandise, and the transportation of the public on its various missions. Therefore, the slightest delay in the removal of snow from the main arteries of traffic, results in serious traffic congestions which are very costly to business and to the public in general. It has been estimated, that a tie-up of traffic resulting from a serious snow storm, costs the business interests of New York City approximately $5,000,000 per day.

It is imperative, therefore, that a trained force and proper equipment be set in motion, at the earliest possible moment, to keep the roadways clear, and by keeping abreast with the storm, prevent the condition responsible for the congestion of traffic.

Traffic has reached such proportions that with a 5-in. storm, a great many streets are not wide enough to provide room for the piled snow and permit traffic to pass at normal speed. Again, speed enters into the problem for, on the rapid removal of the piled snow, difficult as the conditions are, depends the resumption of traffic to normal.

In round figures the area scheduled for snow removal in the Boroughs of Manhattan, The Bronx, and Brooklyn, where the Department functions, amounts to 36,000,000 sq. yd., equivalent to 1,027 miles of 60-ft. streets. The street cleaning and snow removal work in the Boroughs of Queens and Richmond are under the supervision of the Borough Presidents of the respective Boroughs. Of the total area mentioned previously, 2,785,000 sq. yd. are cleaned by the railroads, equivalent to 79.13 miles of 60-ft. streets, leaving 33,215,000 sq. yd. for the Street Cleaning Department to handle. This area is cleaned partly by departmental forces and partly by contractors' forces. The area cleaned by the contractor varies, depending on how many streets of the schedule are assigned to him for snow removal. For a fall of less than 3 in., none may be assigned to him. In the case of a heavy fall the complete contract schedule may be assigned to him.

Snow Removal Organization.—With the installation of modern methods and modern equipment for snow removal, excellent work has been accomplished in the clearing of the streets quickly after each storm. To do this, three large organizations have been formed, namely:

1. The Snow-Fighting Force consisting of 677 Department motor vehicles, with plows attached, assigned to designated areas, 5,500 sweepers and drivers, and 10,000 laborers.

2. The Snow Removal Force, consisting of (a) departmental equipment and labor, and (b) contractors' equipment and labor.

3. The Street Railway Force, consisting of approximately 600 pieces of equipment and 1,500 laborers.

The first or plow organization of 677 pieces of motor equipment in readiness for operation with the approach of a storm, at a given signal, reports to its previously assigned routes, and starts the work of snow-fighting. Within 2 hours after the signal is given, this entire organization is in full operation, pushing snow from the center of the roadway to the curb. The day's work of 24 hours is divided into two periods of 12 hours each, which operation continues over the variously assigned routes until the roadways are completely cleared of snow. The plows work in teams of two machines, each covering areas of ½ lin. mile to 4 lin. miles of roadway, depending on the traffic and other conditions in each locality.

10,000 Emergency Snow Laborers.—Immediately following the issuing of the orders bringing into operation the plow organization, further orders are issued to assign the 10,000 emergency snow laborers to the cleaning of crosswalks, and the piling and "sewering" of snow. These men are enrolled and assigned for work at 115 section stations throughout the city. They are furnished with the necessary equipment, such as shovels, scrapers, picks, etc., and are assigned in squads to definite areas under the direction of a squad leader who is a sweeper of the Street Cleaning Department. This sweeper has been previously trained in the piling of snow, and the disposing of it in sewers on the particular street to which the squad is assigned for work.

To supplement the cleaning of crosswalks by manual labor, the Department has had under observation a four-wheel tractor equipped with a straight-blade front-push plow. The performance of this tractor was so satisfactory that the Department has purchased two cross-walk tractors for further observation, before the final adoption of this type of equipment as a standard.

The second, or snow removal force, is composed of three units:

1. The Departmental Equipment and Labor.—This unit removes all the snow in Manhattan from 14th Street to the Battery, and, in addition, helps to clear the main arteries of the piled snow. In Manhattan, these avenues are Fifth, Sixth, and Seventh. There are also the four large bridges over the East River which, in addition to a considerable number of smaller bridges throughout the city, are handled entirely by Departmental labor and equipment.

This snow emergency work is carried on by the Department in addition to its regular function, which is the collection and disposal of the city's wastes, an average volume of 36,600 cu. yd. of ashes, garbage, and rubbish per day.

In 1926, the equipment available for hauling snow consisted of 900 horse-drawn dump carts and trucks of a total capacity of 1,800 cu. yd., and 1,100 automobile trucks ranging from 2 to 7½ tons, with body capacities from 3 to 14-cu. yd. water-level measurement, of a total capacity of 10,316 cu. yd., and a combined capacity for both types of equipment of 12,116 cu. yd. The Department also owns and has in operation 41 snow loaders of the conveyor type.

2. Contractors' Force and Equipment.—The remaining area is divided into five snow removal districts. In general, they are District 2, Manhattan, comprising that area north of 14th Street and east of Fifth Avenue; District 3, Manhattan, north of 14th Street and west of Fifth Avenue; the Borough of The Bronx, which comprises in its entirety one snow removal district; the Borough of Brooklyn, which is subdivided into two snow removal districts; District 1, containing Street Cleaning Districts Nos. 1, 3, 4, 5, and 6, or, in general, the down-town section of Brooklyn. The remaining area containing six street cleaning districts com-

prises the 2d Snow Removal District of Brooklyn.

The contract for the removal of snow in these districts is awarded, with the approval of the Board of Estimate and Apportionment, to the lowest bidder, at a public letting, held in October of each year. The contract specifies that the contractor in each district may be called out for snow removal work by the Commissioner after any snowfall, regardless of its depth.

It also specifies that the Contractor may start snow removal work of his own accord without the Commissioner's authorization, in snowfalls of 3 in. or greater. The contract further specifies that the Contractor shall remove the snow from certain mandatory streets which, in general, are the principal arteries of traffic. He may be assigned to the removal of snow in certain scheduled streets.

The total contractor forces start removal at 220 different points simultaneously, averaging 8 trucks, each of 4½ cu. yd. capacity per gang, making a total contractor's force of 1,760 trucks and 3,500 laborers. In recent years the contractor has employed with considerable success, mechanical loading devices, such as steam shovels, cranes equipped with buckets, and other devices in use in the general contracting field.

For supervising and checking this contract work, approximately 300 men are drafted from other City Departments.

Disposal of Snow.—All snow is disposed of through water-front dumps previously selected and assigned as such by the Dock Department, or at selected sewer manholes determined originally after a survey, consisting of 55,000 observations made of the flow in the various sewers. As a result of this survey, the sewers in the Boroughs of Manhattan, Brooklyn, and The Bronx, are divided into four classes, depending on the volume and velocity of the flow in the sewers. They are:

(a) Sewers that will take any quantity of snow that can be dumped into them.

(b) Sewers that will take snow that is shoveled or panned into them slowly.

(c) Sewers that will take snow panned or shoveled into them slowly, in addition to which water must be delivered from the hydrant by a hose.

(d) This class of sewer is unavailable for any kind of snow disposal work.

The sewer maintenance crew in each Borough is assigned to the work of keeping the sewers clear of obstructions and freely flowing.

3. The Street Railway Organization.—Under the charters by which the street railway companies operate, they are bound to maintain and keep clear of snow, an area included between their tracks plus 2 ft. outside each outer rail.

In lieu of cleaning the area just mentioned, the Commissioner enters into an agreement with the various railway companies, for the cleaning of an area equivalent to the mandatory areas required to be cleaned by their charters.

Approximately, this area amounts to 3,000,000 sq. yd. The forces of the street railway companies are concentrated at certain prominent thoroughfares throughout the three Boroughs with their own equipment, consisting of flat cars, horse-drawn and motor-driven trucks, snow loaders, and labor.

The railway companies start their snow brooms to clear the tracks along their entire routes as soon as weather conditions indicate that there will be a continued storm. The Department and all snow removal organizations are dependent on the U. S. Weather Bureau for advance information concerning the probability and intensity of the coming storm. In addition, the Department maintains a set of self-recording meteorological instruments.

To handle the modern equipment which the department now employs in the disposal of snow, there has been established, originally under the supervision of the engineers, but now directed by the Superintendent of Equipment and Inspection, a school for the training of the department employees.

Upon the completion of the course, the employee is required to pass a test of the State License Bureau, and also qualify in an examination held by the Civil Service Commission, for the position of auto-truck driver. Three thousand men have passed all tests and have been assigned to operating the motor apparatus.

Snow Removal Data.—Snow removal cost data vary, as snow has no fixed characteristics. A 5-in. storm followed by rain and thaw may be removed at a cost of $150,000, whereas a 3-in. storm with freezing weather and sleet, which would cover the streets with ice, followed by low temperatures, may cost $700,000. The average cost per year for snow removal in New York City, for the Boroughs of Manhattan, Brooklyn, and The Bronx approximates $3,500,000.

The average snowfall for a season is considered to be 28 in. Further, the Department must be prepared for a season of heavy snowfalls, such as occurred during the winter of 1922-23, when more than 55 in. fell. During that winter 27 snow storms occurred, at intervals of about 2 per week. It is estimated that the volume of snow that fell on the streets scheduled for cleaning by the Department was 55,000,000 cu. yd.

Assuming that the weight of snow is 6 lb. per cu. ft., which is about the minimum, there were approximately 4,455,000 tons of snow to be disposed.

The first three storm days, December 7, 14, and 17, 1922, with a total fall of 3.5 in., were handled entirely by Department forces.

From December 28, 1922, to March 19, 1923, there were 24 individual storms coming so closely that it required 81 days of continuous work by the Department forces, the Contractor and the railroads.

During this period, the total area cleaned by the Department forces was 81,446,000 sq. yd., and by the Contractor, 79,215,000 sq. yd., a total of 160,697,0000 sq. yd.; in other words, the original area of 33,215,000 sq. yd. scheduled for removal by Department and contract work, was done over entirely, five times, during the period.

The cost of piling, contract work, and supervision was $2,031,200. The cost of the departmental work was $2,967,900, making a total of $4,999,100.

In conclusion, snow removal in New York City is based on the theory that when the snow begins to fall, plows and snow brooms will be started out to plow and sweep the snow from the center of the street, in ridges, to the side along the curb. At the same time crosswalk plows will clear the street intersections for pedestrian traffic.

During the snowfall, Department motor trucks, and after the snowfall, Department, contract, and railway trucks and loaders are started on the streets at important points, where the ridge is piled, loading the snow into the trucks in order to remove it while it is soft and easy to handle and before it is packed down by traffic. Sewering is the most economical method for the final disposition of snow.

The engineering force, in co-operation with the engineers of the Sewer Bureaus of the various Borough Presidents, are striving for the installation of sewers of adequate size with manholes conveniently spaced on the various thoroughfares, which would be adapted to the disposal of snow directly by plowing and dumping from trucks.

It is proposed to connect the water mains to the sewers directly so that when it becomes necessary to augment the flow, water sufficient for the purpose may be readily utilized.

It has been found that hand labor is non-productive to about 40 per cent of the time, due to the constant stream of passing vehicles in the streets.

With this in mind, the Department is striving for the perfection of mechanical appliances as a substitute for hand labor, and it is safe to predict that within a few years, all snow removal work will be handled mechanically. The success of snow removal depends to a great extent upon the co-operation of the public.

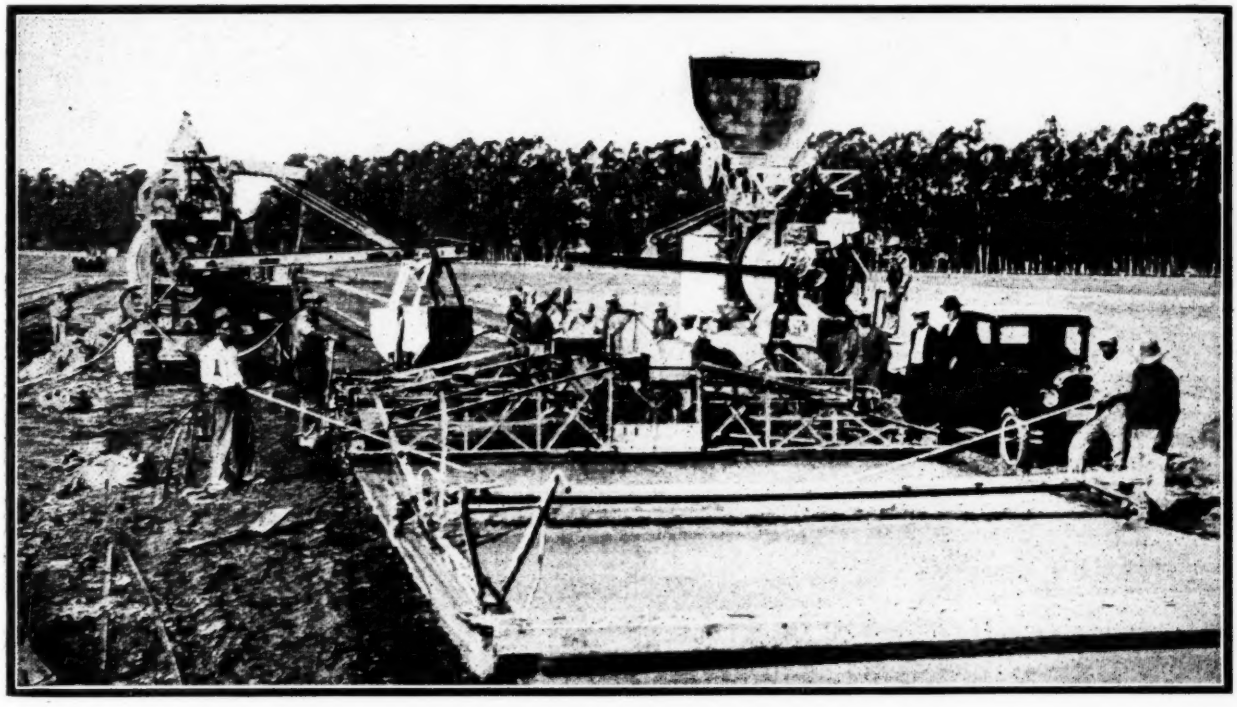
With the public educated to the extent of providing their motor vehicles with skid chains at the first sign of a snowfall, and the prompt clearing of sidewalks, and the piling of snow at the curb, making a single mass of the piled and ridged snow in the streets, the problem will be greatly simplified.

The Oxnard Experimental Pavement

How Five Miles of Concrete Pavement Carrying Heavy Traffic Was Built With Variations in Reinforcement and Transverse Joint Spacing, and of Two Thicknesses, in Various Combinations in Thirty-eight Sections, Described in Public Works

There was completed a short time ago a concrete pavement about five miles long in Ventura county, California, between Oxnard and the coast, which was used by the State Highway Department as an experimental pavement, chiefly for testing the relative effectiveness of different systems of steel reinforcing and methods of placing same, and of transverse joint spacing. The flat grades and straight alignment, with no breaks in the continuity of the pavement, and the almost uniform sandy soil subgrade, presented an ideal opportunity for such a test.

Unlike the test roads at Pittsburg, Cal., and Arlington, Va., this pavement has been built for practical every day use by heavy road traffic. In the general construction of the pavement there was no radical departure from accepted practice, and it is expected that the entire road will give excellent service, but that the differences in details will be reflected in the action of the different sections under traffic.



Double Mixer method of laying pavement

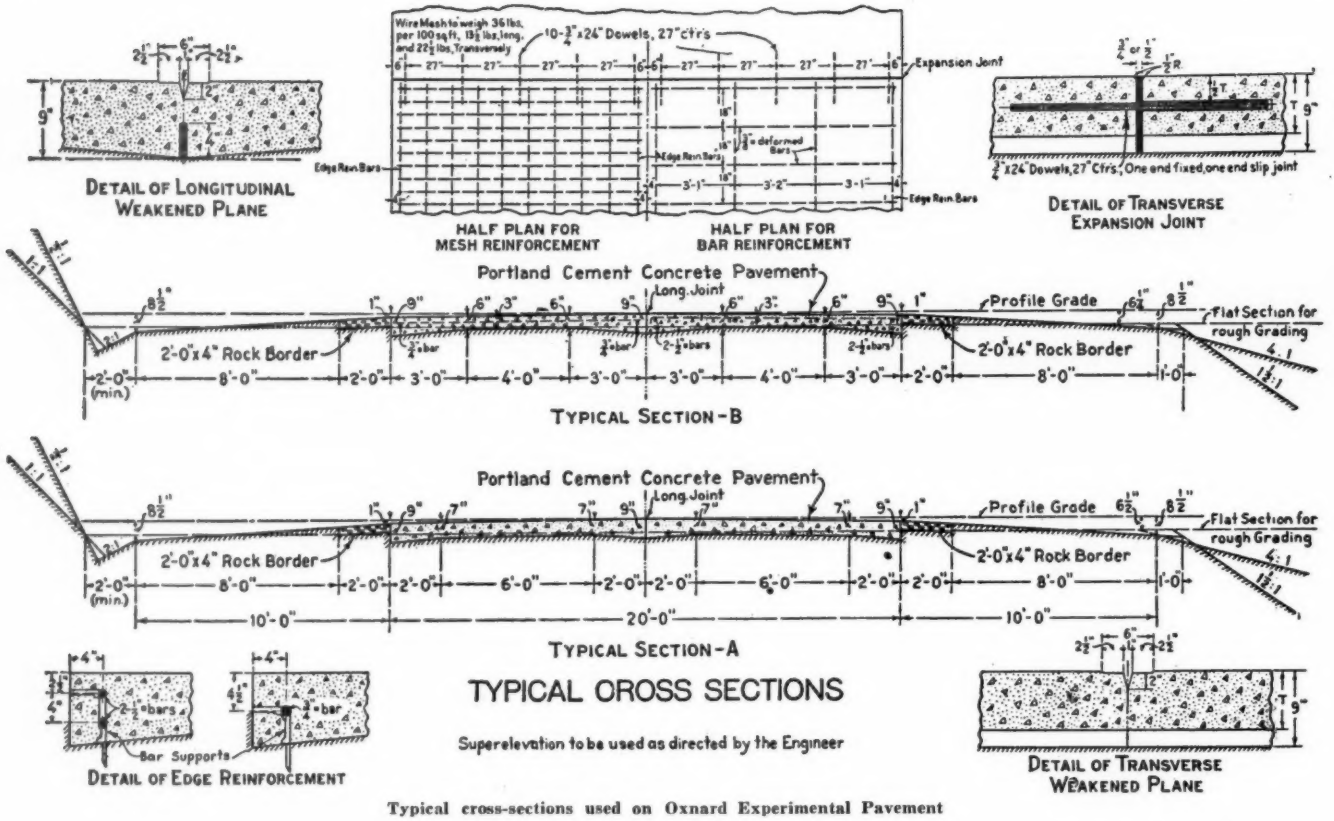
Two typical sections, known as A and B, the former with a center thickness of 6 inches and the latter 7 inches, were used. A center joint is carried the full length of the road. Expansion joints were placed at intervals of 50 ft. with weakened planes 25 ft. from them; and at intervals of 60 ft. with weakened planes 20 ft. apart; and 50 ft. apart without intermediate weakened planes. Reinforcement consisted of each edge reinforced with 2½ in. square deformed bars, with and without slab reinforced with mesh or with bars; or with 1¾ in. square deformed bars; with and without slab reinforced with mesh or with bars. These several details were combined in various ways in 38 different sections, each 1200 feet long except the four end ones. The pavement was described in "California Highways" by A. D. Griffin, resident engineer, Division VII, as follows:

The pavement changed every 1200 feet, except for two longer sections at the beginning and end of the contract. Arrangement of the different sections is such that any effects due to possible variations in quality of the subgrade, or a heavier traffic in one direction than in the other, will balance one another when the results for the entire five miles are combined and compared.

The centerline V-groove under which is placed a submerged wood strip and the transverse dowelled expansion joints, as used on this contract, are now standard California practice. The weakened plane transverse joints, to afford relief for tensile stresses by encouraging and localizing contraction cracking, are a new procedure, although a development of the same idea has been used by the city of Seattle. The concrete mix was all standard Class "A," six sacks of cement to the cubic yard, except for a short section which is subsequently described.

To guard against corner cracking where longitudinal edge and center bars were specified, the same type of reinforcing was carried transversely across the slab parallel to all expansion joints, except where slab reinforcement was used, when the precaution was considered unnecessary. A break in the longitudinal steel was always provided at all transverse expansion and weakened plane joints; no steel passed through the joints except the ¾ in. x 24 in. steel dowels. These were placed with slip-sleeves on one end to provide space for expansion. Ten dowels were used in each of the expansion joints, and four dowels in each of the weakened planes. In the latter instance the dowels were spaced 6 in. from the edges and center of the pavement. Dowels were held firm by wiring them to steel pins, ½ in. x 12 in., which were driven into the subgrade as supports. Placing of dowels was given particular attention throughout the project.

Construction Program.—N. L. Basich and R. H. Richards, who represented


DETAIL OF LONGITUDINAL WEAKENED PLANE
HALF PLAN FOR MESH REINFORCEMENT
HALF PLAN FOR BAR REINFORCEMENT
DETAIL OF TRANSVERSE EXPANSION JOINT
Portland Cement Concrete Pavement
Long. Joint
Profile Grade
Flat Section for rough Grading
2'-0"x4" Rock Border
TYPICAL SECTION-B
TYPICAL SECTION-A
TYPICAL CROSS SECTIONS
Superelevation to be used as directed by the Engineer
DETAIL OF EDGE REINFORCEMENT
DETAIL OF TRANSVERSE WEAKENED PLANE

Typical cross-sections used on Oxnard Experimental Pavement

the contractor, the United Concrete Pipe and Construction Company, appreciated the fact that the contract was unique in its variety of exacting requirements. They realized also the disadvantages of the usual method of hauling concrete paving materials and of conducting mixing operations on a subgrade composed of the prevailing sandy oil. Earth structures, 10 feet in width, had been planned for either side of the 20-foot pavement, which permitted two 5-sack mixers to be operated opposite each other, and entirely outside the pavement side forms.

Pneumatic-tired dump trucks delivered proportioned batches of rock and sand from the Saticoy Rock Company. All traffic was kept entirely off the subgrade, the hauling being done either along the shoulders or in the side ditches.

This arrangement made possible the lining up of pavement steel and transverse joints well in advance of the placing of the concrete. It also diminished confusion around the mixers and made for better progress. To further speed up operations, the contractor provided two Lakewood tampers which worked in conjunction with one another, except for short periods when repairs were necessary.

When weakened plane joints were being placed, nine finishers were required to take care of a normal day's run. Adverse weather conditions prevented any record of exceptional progress on the job as a whole, but on many days over 400 cubic yards of pavement were placed. This is better than 900 linear feet.

Steel Reinforcement.—Three methods were used for the support of longitudinal steel bars in the pavement slab:

(1) ½ in. x 12 in. steel pins which were driven into the subgrade and to which the longitudinal bars were wired;

(2) Movable braces, an invention of the contractor, which were taken out after the concrete had been spread and which were then reset;

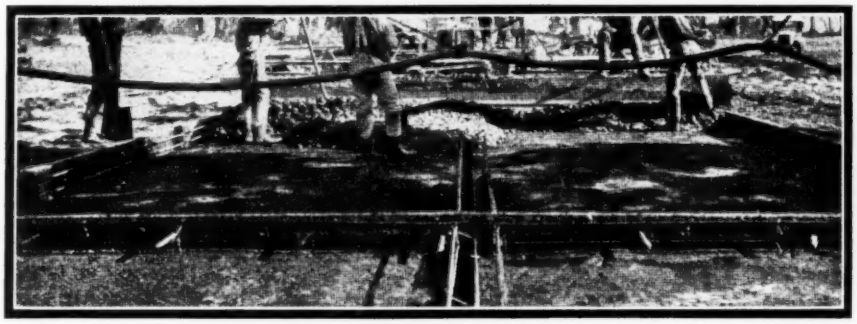
(3) Stiff No. 8- or No. 10-gauge wire supports, bent and welded with stop bars and hooks, which were driven into the subgrade and the headers and left permanently in place.

This last mentioned method proved by far the most satisfactory. The wire supports made possible setting of the reinforcing well in advance of placing of concrete. The bars were held firmly in place not only vertically and horizontally, but also longitudinally which is particularly important where breaks in the reinforcing steel must be accurately spaced for weakened plane transverse joints. The wire supports when left in place also insured against movement of the reinforcing steel during tamping operations. All other methods of steel support have obvious disadvantages.

When slab reinforcement was accomplished with wire mesh or ⅝ in. steel square deformed bars, the procedure was as follows:

Using two tampers for finishing pavement

A layer of concrete was struck off with a template at the depth at which the reinforcement was to go for the full distance between expansion joints. The wire mesh sheets or the previously made up mats of steel bars were then



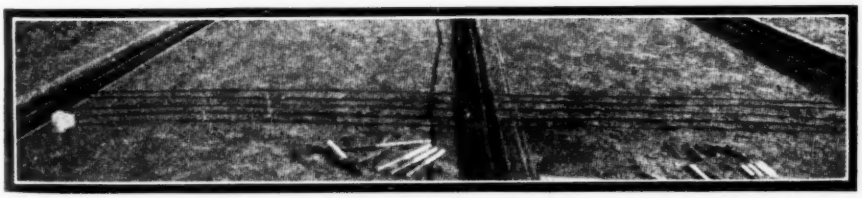
Holding reinforcing steel with movable braces

placed and wired to position. The mixers were moved back and the top layer of concrete was deposited, tamped, and finished in the usual manner.

Of the various methods tried other than the use of wire supports, the placing of the concrete mix in two layers appeared to give the best results from the standpoint of getting and holding the steel in its proper place. To meet objections to this procedure, dusty side roads were sprinkled, the first course of concrete on hot days was run slightly wetter, and burlap mats were provided on which workmen wiped their feet to avoid tracking dirt onto bottom course of freshly laid concrete while placing the steel.

Transverse Joints.—Considerable difficulty was experienced in the construction of transverse weakened plane joints. The spceial provision of the contract showed the transverse V-groove to be the same as the longitudinal center-line V-groove. An effort to follow this requirement indicated that the resulting transverse joint would not be smooth; a clean-cut V-groove by this method seemed impossible of construction without making an objectionable depression.

A method developed by Resident Engineer E. B. Brown, of Division V, for shoulder construction, was enlarged

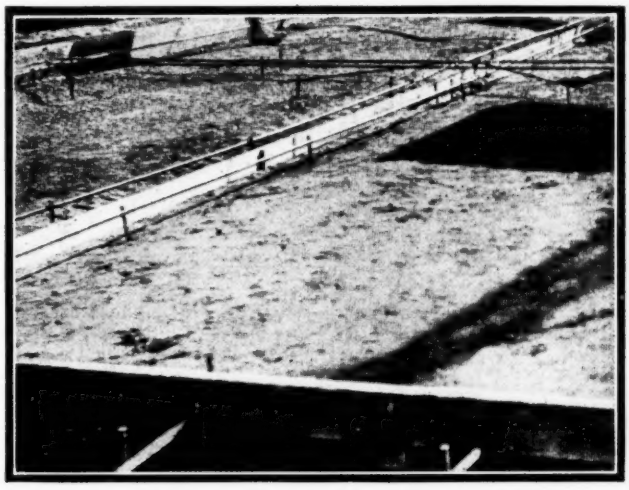


Holding steel with specially fabricated wire supports

upon and was finally adopted for full width pavement. Under this plan the V-groove tamper was impressed in the concrete after the heavy longitudinal float had passed. In this groove a ¼ in. x 1½ in. x 19 ft. 10 in. steel plate, bent to roadway crown, tapered, and drilled with holes near the top to facilitate pulling, was placed about ¼ in. below the surface of the concrete. Longitudinal floating was then carried on until the pavement over the plate was as smooth as elsewhere. After the concrete had dried out sufficiently, an edger was run along both sides of the plate, giving it the appearance of an expansion joint. After about four hours the concrete was generally hard enough for the plate to be pulled and used over again. Great care had to be taken to keep the plates scrupulously clean and well oiled, as otherwise corners would be broken off in the pulling.

Departures from Prescribed Designs.—Between Stations 22+60 and Station 25+00, a part of typical section "A," the Construction Department directed that the concrete be poured five sacks to the cubic yard instead of six. Special reinforcement also was used as shown by the accompanying sketch. The ¾ in. smooth round longitudinal bars used on this section were greased in an effort to cause them to act as dowels over their entire length. Subsequent comparisons of this section with other sections which contain ¾ in. square deformed longitudinal bars, should determine whether or not the bonding of steel to concrete for the transference of tensile stresses is of as much importance as the dowelling action, in the absence of a bond between the two. This section should also prove or disprove the advisability of providing against corner breaking by placing bars at 45-degree angles.

From Station 37+50 to Station 39 +50 poor local drainage conditions decreased the bearing power of the subgrade. To overcome this condition an additional inch in the thickness of the concrete slab and additional steel were authorized. This consisted of deformed longitudinal bars ¾ in. square placed at the edge and center in the southwesterly half of the pavement and also standard reinforcement of ⅜ in. bars



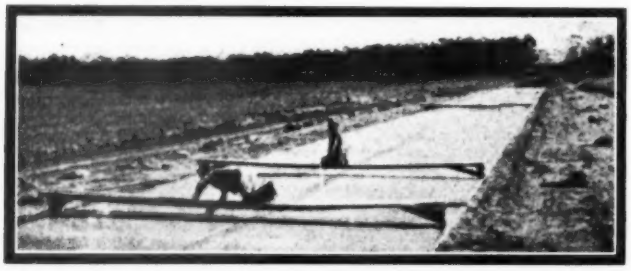
Steel reinforcing bars held by steel pins

placed on both sides two inches from the top of the slab.

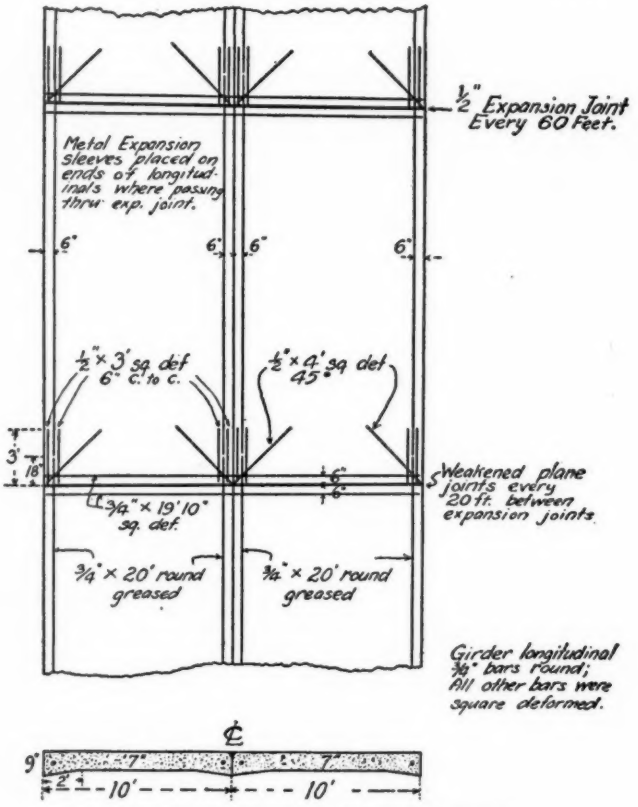
On the three northerly sections containing slab reinforcement, Station 42 +00 to Station 54+00, Station 66+00 to Station 78+00, and Station 90+00 to Station 102+00, the steel was placed two inches from the top instead of three inches as originally designed. This change was authorized because it was thought that, by being placed nearer the top, the reinforcement might be more effective in taking up tensile temperature stresses and the flexural stresses of heavy concentrated traffic loads. After the highway has been in use, comparison of these sections with the three where the steel is in the center of the slab should be of interest.

Because of high alkali content in the soil from Station 226+00 to Station 256+00, the completed subgrade was given two applications of asphaltic road oil to secure an insulating membrane

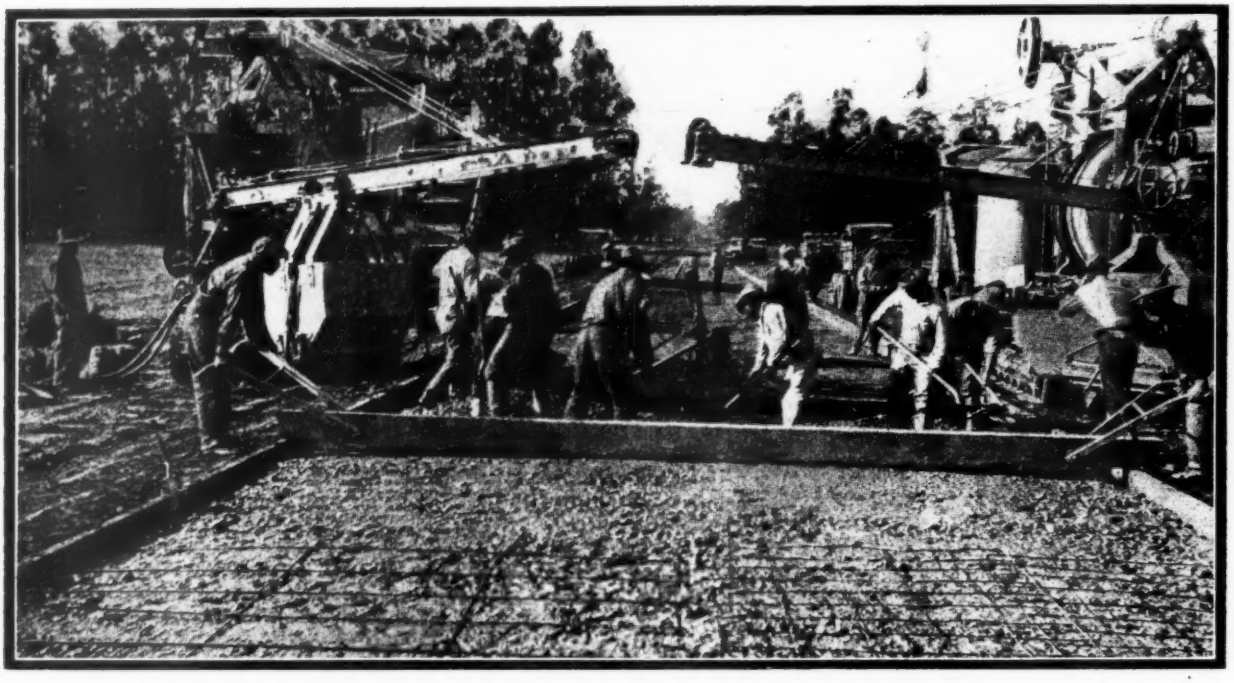
Impressing V-groove tamper for a transverse weakened-plane joint



Finishing transverse expansion and weakened-plane joints. Joints 20 feet apart



Special reinforcement of five-sack concrete

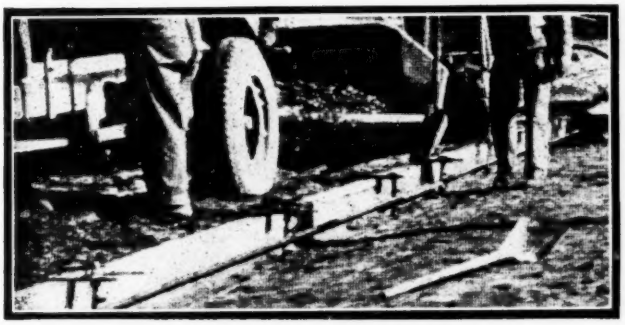


Wire mesh on one side, three-eighths inch square deformed bars on the other

under the pavement. The first application was of oil with a 40 to 50 per cent asphaltic content, one quart to the square yard of subgrade; the second application was 80 to 90 per cent asphalt, in the same amount per yard. This oil treatment was also considered a protection against the shrinking and expansion of the subgrade; and, for this reason, a sand cushion between the subgrade and the pavement, which would otherwise have been placed on the northern half of this section, was eliminated. The soil was of an adobe nature having a linear shrinkage of from 5 to 8 per cent.

Station 199+00 to Station 210+00 was the first section constructed in which slab steel reinforcing was used. While building this unit the contractor was permitted to do some experimenting in the placing of the steel. For this reason the reinforcement on this section is more likely to be defectively placed than that used elsewhere on the project.

Except as above outlined, no other

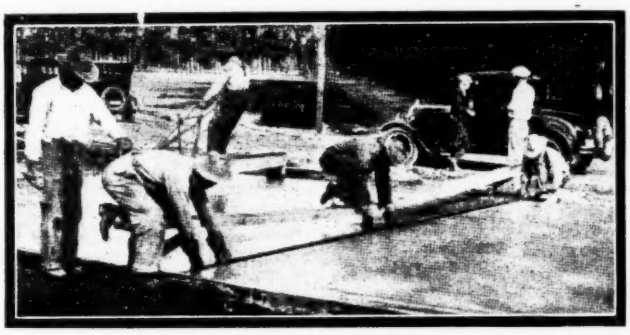


Half-inch steel reinforcing bars held in place by steel wickets

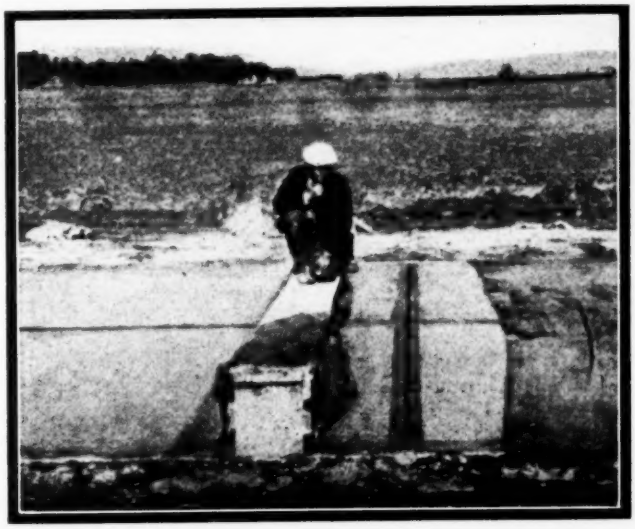
deviations were made in the original plans, nor do any further conditions come to mind which would seriously affect any conclusion which may be drawn from subsequent studies and comparisons of the various types of pavement design. As time goes on, it is hoped that these experiments may settle some of the moot questions regarding pavement design, steel reinforcement, and transverse joint spacing which have not been as yet satisfactorily or conclusively answered.

Inspection parties who may go over this contract should have no trouble in picking up stations or in identifying the various sections, even without a copy of the layout plans. A different transverse joint spacing often marks a point of change in design. The contractor's stamp, placed at the beginning and the end of each day's run, also carries the station and the date. At points of change of design, the station number has been branded on either side of the expansion joint near the edge of the pavement.

Beside the state engineers, representatives of the steel companies and of the cement associations, city and county engineers, were frequent observers on this contract and valuable suggestions were received from these sources. A. D. Griffin, as resident engineer, was in general charge for Division VII. The inspection work was done by the following assistant resident engineers; W. I. Templeton, T. A. Rosebury, E. W. Taylor, O. W. Monroe, B. T. Thomas and J. P. McAndrew.



Submerging one-fourth inch by one and one-half inch by 19 feet ten inches steel plate. Finishing carried on over top of plate



Completed transverse weakened-plane joint after edging and pulling of plate

For the illustrations presented herewith we are indebted to Mr. Griffin and S. V. Cortelyou, division engineer.

One-Sixth National Population Feel Highway Accidents in Five Years

Nearly one-sixth of the nation's entire population has directly or indirectly suffered from highway accidents during the past five years, says the American Road Builders' Association in an appeal for the practice of courtesy and caution on the public thoroughfares. The road hog, described as "the most contemptible figure on the highway today," is the center of a vigorous appeal for sane driving.

"About 3,500,000 people have been killed or injured on the street and highway during the past five years," according to the association. "Assuming every death or injury to affect either directly or indirectly five persons, between 17,000,000 and 18,000,000 people have suffered from these accidents. At this rate within the present generation the entire population of the country will have experienced the horrors of highway accidents.

"The road hog is the cause of innumerable accidents, many of which cannot be proven the fault of this dangerous driver. Physical conditions often make it nearly impossible to blame him after the damage has been done.

"The road hog is the man who drives casually along in the center of the road and fails to give the right-of-way to others who wish to pass at a reasonable speed. He is the man who selfishly refuses to relinquish the right-of-way when it is to the advantage of many other motorists. He is the driver who will hold up traffic in order to receive a passenger in a congested district. In general, he is the man who regards the highway almost as his personal property.

"Often persons who are extremely courteous and cautious in their social or business life will shake off all semblances of these principles behind the wheel of an automobile. It is these persons who become the selfish and dangerous hazzards of the highway—the road hogs. The practice of the same courtesy and caution on the street and highway that is used in the office or in the home will do much to reduce the appalling number of casualties each year.

"The practices of the road hog are selfish practices, and are not in sympathy with modern methods of transportation. Every individual should resolve to remain out of this category by the volutary practice of courtesy and caution."

Municipal Bond Issues in Minnesota

The New Law, Described in the National Municipal League's Journal, The National Municipal Review

By GEORGE M. LINK

Secretary, Minneapolis Board of Estimate and Taxation

The legislature of Minnesota has for the first time in twenty-two years attempted to revise and improve procedure relative to the issue of municipal bonds. In 1905 statutes were passed which specified various conditions under which municipalities of the state could issue bonds, the method of calculating "net debt," the limitations on "net debt," limitations on interest rates, procedure to be followed in securing funds for the payment of the bonds, and other matters that seemed of major importance relative to municipal borrowings.

A résumé of laws authorizing bond issues by municipalties in Minnesota, compiled in 1924, by Mr. W. A. Gray of the League of Minnesota Municipalities, showed that at that time there were on the statute books of the state 143 laws for the purpose of either preventing, permitting or controlling the issue of bonds by cities and villages, exclusive of laws applicable to townships and school districts. Of this number not one applied to all municipalities of the state, 43 applied to all cities of particular classes or to villages, and 100 applied to but one village or city (64 applied to Minneapolis alone).

Fortunately, an active ally in a movement for reform was found in the investment bankers of the state, who probably perceived more clearly than others the need for remedial legislation.

History of the Measure.—Working jointly, the investment bankers and the League of Minnesota Municipalities drafted two measures which were submitted to the legislature of 1925. One of these measures was intended to control the issue and retirement of all future bond issues, the other to control the retirement or the refunding of past issues. Unfortunately the provisions of the measures were not well understood by some members of the League, resulting in opposition and ultimate defeat of both. An immediate movement was put under way for the drafting of a bill or bills for submission to the 1927 legislature. In order that some measure of improvement might be made, it was decided to avoid controversy and opposition on the less important phases of bond procedure by omitting provisions relative thereto if necessary.

There are in Minnesota certain municipalities that, in the past, have issued obligations almost without hinderance and in consequence are now reluctant to have the facts relative thereto made public. There are others that in the past have made little or no definite provisions for the retirement of outstanding bonds. Both classes objected to any law which would now require definite accounting relative to such obligations. It was decided that this opposition warranted omission of legislation relative to past bond issues, and the restriction of any new bill to future obligations only. Likewise the general belief in Minnesota in "home rule" in municipal affairs, and the suspicion with which any form of state supervision thereof is regarded, served to prevent favorable consideration of any proposal by which authority over bond issues could be placed in a central state body.

It is said that Minnesota has given more extended scope to the "home rule" principle in local government than has any other state in the Union. It certainly would be hard to conceive of any people guarding more jealously their "home rule" rights and notions than do those of this state. Unfortunately, what is oftentimes hailed as "home rule" is bloc rule or official rule and not popular rule.

The proposal finally decided upon for submission to the 1927 legislature went before that body with the joint endorsement of the League of Minnesota Municipalities and the Investment Bankers of Minnesota. (The complete text thereof appears in the League publication, Minnesota Municipalities, for December, 1926, page 594.) It was so drafted as to reduce interference with existing procedure, particularly in so-called "home rule" cities, to a minimum.

The bill was not in the form of an enabling act; it did not authorize the issue of any municipal obligations that were not otherwise authorized. The entire aim of the bill was to provide a definite procedure which should be general in application and as nearly uniform as practicable. On the other hand, it was not intended that passage of the bill should deprive any municipality of rights which it possessed under existing laws except to the extent that such laws were in conflict with the proposal.

By thus minimizing the interference of the bill with existing procedure, it was accorded a degree of favor in marked contrast to the opposition which similar proposals had received at the hands of former legislatures, and it passed in substantially the form in which it was presented (see Chap. 131, Laws of 1927).

Comparison With Model Bond Law.—A comparison of this Minnesota law with the Model Bond Law, recently made public by the National Municipal League, shows many marked differences, which may lead the superficial critic to conclude that the proponents of the Minnesota law failed to secure that measure of completeness and perfection which should be attainable in these days when information is so plentiful as to both sound and unsound procedure. To those who thus draw conclusions relative to the Minnesota law as contrasted with the Model Bond Law, it can be said that the Minnesota law did not attempt to lay out a complete bond procedure for the reason that there were existing laws that adequately and satisfactorily covered many phases of such procedure; it did not result in perfection for the reason that a theoretically perfect plan could not have been adopted. The proponents of the bill aimed to correct those provisions of existing law which were responsible for the greatest abuses in bond procedure. Local students of sound bond procedure are agreed that this objective was attained. It is also believed that the procedure which will be required in Minnesota when this law becomes effective (September 1, 1927) will differ from that required under the Model Bond Law less than would be assumed if one were to accept as correct a comparison appearing in the March issue of the National Municipal Review.

New Procedure Defined.—The procedure prescribed by the Minnesota law is approximately as follows:

1. Certain Obligations Excepted from the Provisions of the Act as to the Issuance Thereof.—All warrants or orders having no definite or fixed maturity and all bonds (a) issued by a county for road purposes to the extent that reimbursement will be made by the state, (b) authorized to be issued and sold to the state, (c) issued for improvements which are payable wholly or partly from special assessments, (d) issued for the creation or maintenance of a revolving fund, (e) issued for the construction or repair of wharves and docks, and (f) issued and maturing in less than one year are excepted from the provisions of the act as to the issuance thereof. (This exception does not, however, remove such obligations from the restrictions of existing statutes or charter provisions.)

2. Net Debt Re-Defined.—Net debt is defined as the amount remaining after deducting from the gross debt (the total of all outstanding obligations of every kind) (1) the sinking fund reserve for the retirement of those bonds

which make up the net debt, (2) all outstanding bonds issued (a) for the acquisition, construction, maintenance, etc., of water works systems, lighting, heating or power systems, or combinations thereof, (b) for improvements payable wholly or partly from the proceeds of special assessments, (c) for the creation or maintenance of a revolving fund, and (3) warrants or orders having no definite or fixed maturity. An exception as to the application of such methods of computing net debt is made of municipalities which by special law or home rule charter have another method prescribed. This exception is made necessary by the conditions of existing general laws relative to special charters and home rule charters. (This method of determining net debt will probably be judged adversely when compared with those laws which permit the deduction only of water bonds and sinking fund reserves. It has the merit, however, of a degree of definiteness which is entirely lacking in the Minnesota law of 1905, under which all present outstanding bonds have been issued. Such law provided for the deductions of all bonds for improvements from which an "income is or may be derived," also for the deduction of sinking fund reserves for bonds which were not to be included in a statement of net debt.)

3. Limitations on Net Debt.—A limit of 20 per cent of assessed valuation is fixed for school districts, and of 10 per cent for all other municipalities, with the following exceptions:

(a) Cities of 50,000 or more inhabitants are limited to a net debt of 5 per cent of assessed valuation, exception being made of such cities as have a home rule charter fixing a higher limit, and

(b) All municipalities which by special law or home rule charter have a lower limit prescribed.

At the present time there is no fixed and definite limitation on the net debt of school districts.

4. Serial Bonds Required.—All obligations which become subject to the provisions of the act as to the issuance thereof are to be payable serially, the first installment thereof not more than three years after date of issue and the last thereof not more than thirty years from the date of issue. The last installment of funding or refunding bonds and of those issued for other purposes which are not specifically limited to thirty years, are payable in not more than twenty years from the date of issue. No installment shall be more than two and one-half (2½) times the amount of the smallest installment.

5. Bond Authorization Subject to Referendum.—No bonds which are subject to the provisions of the acts as to the issuance thereof can be authorized without the approval of a majority of the electors of the municipality, except bonds to pay judgments or to refund maturing obligations or bonds which are to be issued by home rule cities the charters of which permit the issue of bonds without such vote.

6. Tax to Be Levied to Retire Bonds, Prior to Issue.—Prior to the issue of any bonds subject to the restrictions of the act, a tax shall be levied for each year covered by the issue in an amount five per cent (5 per cent) in excess of the amount to be paid thereon during each of said years, which tax, after the issue and delivery of the bonds, shall be irrepealable until all the indebtedness created is paid. Provision is made for the disposal of any excess produced by such levy or for an additional levy in case of deficiency in collection. The spreading and collection of such levy is made the duty of the county officials.

7. Registration of Bonds and Certification of Registration.—The county auditor is required to keep a register in which shall be entered a record of every issue subject to the provisions of the act. No such bonds can be delivered to the purchaser thereof until a certificate has been obtained to the effect that said bonds have been registered and that a tax has been levied for the retirement thereof.

Cities of over 50,000 inhabitants are excepted from the provisions relative to such certificate.

8. Penalty for Failure to Carry Out the Provisions of the Act.—Any officer of a municipality who knowingly fails to comply with the provisions of the act is declared to be guilty of a misdemeanor.

Will Correct Abuses.—It is generally conceded in Minnesota that the procedure provided in the new law will correct some of the worst practices of Minnesota municipalities in the issuance of municipal obligations. The method of determination of "net debt," though probably not the most desirable, will eliminate some of the most unsound features of the procedure permitted by former laws; the requirement that certain standard and ordinary obligations shall be serial will encourage the issuance of all obligations as serial obligations; and the requirement that a tax shall be levied to care for the retirement of the bonds to which the act applies and for the payment of the interest thereon will prevent, at least in part, the practice which is all too common of failing to make annual and adequate provision to meet such obligations.

That the new law leaves much to be desired in future legislation must be conceded. There is no sound reason for excluding any general obligations from the requirements of a sound bond procedure as to issuance, redemption provisions, registration or any limitations that apply to other general obligations. (Exception may properly be made in case of obligations to be sold to the state or to be redeemed by the state, for obvious reasons.) There also is no good reason for continuing to use assessed value as the basis for determining net debt instead of full and true value, or for retaining the rather absurd method of determining "net debt" by permitting deductions from "gross debt" obligations which clearly must be retired by the process of general taxation. An ideal definition of "net debt" is one that specifies that such debt is that portion of the requirements for the retirement of existing "gross debt" which must be met in the future by the proceeds of general taxation. This definition is substantially in accord with the procedure for determination of "net debt" as contained in the Model Bond Law.

Comment has been made that the Minnesota law excepts from its provisions, to a great extent, cities operating under home rule charters. It appeared to be impossible to pass the law unless such exceptions were made, but such exceptions released such cities from only a part of the provisions of the act. It is believed that provisions which were not so excepted are ample justification for the adoption of the act, despite its various imperfections.

Something Remains to Be Done.—As is generally true in case of remedial legislation, the Minnesota law is now being picked to pieces by its critics. It is being claimed that the law will not accomplish anticipated results, that certain defects in drafting render it unconstitutional, that superficial preliminary investigation resulted in the inclusion of a provision that will reduce the net debt limit for Minneapolis (the largest city in the state) from 10 per cent to 5 per cent of assessed valuation (the present debt is over 9 per cent of such valuation), and that the act is defective in certain other respects. Proponents of the law are of the opinion that all such objections and criticisms are without adequate foundation. A comment recently made in the National Municipal Review is, however, substantially correct: "It would seem possible to strengthen the Minnesota proposal in several points. Some definite procedure could be outlined to take care of present indebtedness; control of debt could probably be better administered in the state than in the county government."

It is too early to predict the attitude that will be taken by the League of Minnesota Municipalities before the next session of the state legislature. It is possible that the League will recommend further legislation relative to the issue of municipal obligations. It is more likely, however, that their activity will be confined to the promotion of legislation having for its purpose the supervision and control of accounting and budgeting.

The New Sewage Treatment Plant of Trenton, N. J.

General Description of $1,243,000 Installation Given in Paper Presented at the Twelfth Annual Meeting of the New Jersey Sewage Works Association

By P. N. DANIELS
City Sanitary Engineer, Trenton, N. J.

The sewage treatment plant just completed for the city of Trenton has a design capacity of 25 million gallons per day average dry weather flow and is to handle up to 37.5 million gallons per day when storm flows occur. In brief, the plant consists of an overflow chamber, a gate house, screen racks, double grit chamber, pumping station, 12 Imhoff tanks, 24 sludge drying beds, and necessary appurtenances.

Grit Chamber and Screen Racks.—The racks are made of 1-in. x 2-in. bars set 2-in. center to center, 15 ft. long, the entire rack being 8 ft. wide and set at an angle of approximately 23° from the horizontal. The grit chambers are of trapezoidal section in duplicate, each 60 ft. x 8 ft. 6 in. wide at the top and 5 ft. wide at the bottom, maximum depth about 5 ft. Velocity through these is closely regulated to 1 ft. per second by the variations in pumping over the elevation range in the pumping station wet well.

Material settling in the grit chambers is removed by a clam shell bucket locomotive crane electrically driven and traveling the length of the chambers on rails set on the outside concrete walls. A concrete roadway surrounds the grit chamber with inset industrial railway tracks so that grit and screenings may be either dumped on the pavement for drainage or placed directly in the dump cars hauled by a gasoline locomotive. Road drains carry drainage back to the grit chamber.

Tanks.—The settling tanks, which will settle out the large solids, are of the Imhoff type and are 12 in number. Sewage is delivered from the pumping station to a comprehensive system of inlet and outlet channels so arranged that the flow may be diverted to any number of compartments desirable and may be reversed.

Settling Compartments.—The rectangular section of each tank is 11.75 ft. x 6.5 ft. x 114 ft. x 2 or 17,440 cu. ft. The triangular sections will be ½ x 8 ft. x 11.75 ft. x 114 ft. x 2 or 10,720 cu. ft. The total settling capacity of each tank is 28,160 cu. ft. The total capacity of the 12 tanks is 12 x 28,160 x 7.5 or 2,540,000 gal.

The detention period at a 18,000,000 gal. per day present average rate of flow is 3.39 hours. The detention period at the future rate of flow of 25,000,000 gal. per day will be 2.44 hours, while the detention period at the maximum peak rate of 37.5 million gallons per day will be 1.63 hours. Thus, it may be said that the tanks are designed to give a detention period of approximately 2½ hours for the designed future rate of 25,000,000 gal per day average flow.

Gas Vent Areas.—The surface gas vent area of each tank is 8.5 ft. x 87 ft. or 740 sq. ft. The total area of each tank is 114 ft. x 33 ft. or 3,762 sq. ft. Thus the per cent of gas vent area is 19.8.

Sludge Chambers.—The pyramidal portions of the sludge chamber of each tank have a capacity of 1/3 x 20 ft. x 24 ft. x 6 ft. x 4 or 3,840 cu. ft. The rectangular sections have a capacity of 9.25 ft. x 20 ft. x 24 ft. x 4 or 17,750 cu. ft., giving a total sludge capacity for each tank of 21,590 cu. ft. The total sludge capacity of the 12 tanks is 12 x 21,590 or 258,000 cu. ft. Assuming a population of 130,000, the sludge capacity per capita is 1.98 cu. ft. With a future designed basis of 150,000 persons, the capacity will be 1.72 cu. ft. per capita.

With a gas vent area of 740 sq. ft. for each tank and a sludge storage capacity of 21,590 cu. ft., the ratio of gas vent area to sludge capacity is .034 sq. ft. of gas vent area per cu. ft. of sludge storage.

Openings Between Sludge Compartments.—Since there are 4 hopper bottoms in each tank there will be 3 points at which it will be desirable to permit sludge to pass freely between compartments so as to permit an even distribution of sludge. Each of the openings between the compartments is 3 ft. in depth x 16 ft. in width, giving an area of 48 sq. ft.

Scum Capacity.—Assuming the scum capacity of each tank to extend from the water level down to the bottom edge of the side wall of the settling compartment there will be in each tank a rectangular section and a truncated pyramidal section. The capacity of the rectangular section will be 8.5 ft. x 6.67 ft. x 87 ft. or 4,980 cu. ft. The capacity of the truncated pyramid will be (18 ft. x 100 ft. + 87 ft. x 8.5 ft.) — 2 x 7.67 ft. or 9,750 cu. ft., giving a total capacity for each tank of 14,730 cu. ft. The total scum capacity for the 12 tanks is 12 x 14,730 or 177,000 cu. ft. With a population of 130,000 this gives 1.36 cu. ft. of scum capacity per capita and, with a designed future population of 150,000, the capacity will be 1.18 cu. ft. per capita.

Sludge Beds.—The sludge beds are 24 in number, each 20 ft. wide and 182 ft. long, having a combined area of 87,400 sq. ft. On a basis of 130,000 population, this gives 0.67 sq. ft. per capita and on a basis of 150,000 population will represent 0.58 sq. ft. per capita. An industrial railroad track is placed longitudinally in the center of each bed to promote ease in removing and handling sludge. The underdrains in the bed are spaced 13 ft. center to center and are laid in trenches surrounded by stone. The filtering material on the beds consists of 3 layers of gravel graded from a minimum of ⅛ in. up to a maximum of 2½ in. A 2 in. layer of sand is placed over the surface of the gravel. The minimum depth of filtering material is 10 in. and the maximum depth 14 in. on the main sections of the bed. The depth to the lateral underdrains is slightly more than 14 in.

The sludge is to be drawn from the tanks by gravity through 8 in. cast iron pipes with a maximum center line drawing depth of 4 ft. 9 in. The sludge will be delivered onto a concrete slab at the upper end of each bed and will flow by gravity out over the bed. Provisions have also been made to remove scum from the gas vents through a rectangular concrete trough which will deliver the scum to an intercepting pipe line from which it will be carried to one of the sludge beds.

Pumping Station.—The pumping station is circular in shape, with the substructures constructed of reinforced concrete, and a brick superstructure. This type of construction was decided upon on account of being less expensive, requiring less concrete and steel and its being easier to take up stresses, etc. The pumps are located in a circular well, 30 ft. in diameter and 30 ft. deep, having 24 in. thick concrete walls, surrounding which is a circular suction well, 50 ft. inside diameter, having 24 in. thick concrete walls. The sewage is discharged into the well from the grit chamber effluent through a 48 in. concrete pipe. The bottom of the suction well is channeled so as to minimize sludge deposits, and the pump suction connections are placed in circular pockets below the bottom of the channel. Two intermediate landings are provided between the pump and motor floors, acting as pump shaft bearing supports and stairway landings. The superstructure is circular in shape and is of brick construction, having red tapestry brick facing, with limestone trim. There is a circular monitor over the interior of the structure, which extends above the superstructure, and is provided with windows for light and ventilation. The roofs are supported by steel trusses, overlaying which is a cinder concrete roof covered with black slate shingles. The entire floor, including the lavatory,

office and laboratory, is covered with red quarry tile flooring, and a white glazed tile wainscot 6 ft. high is placed on the inside of the wall. The brick walls above this and the inside of the trusses are plastered.

General elevations of the structure and the conditions of pumping are as follows:

Present surface of ground at site	Elev. 56.0
Finished surface of ground around Pumping Station	Elev. 68.0
Floor of Pumping Station on which motors are placed	Elev. 68.5
Floor of pump well in which pumps are set	Elev. 38.0
Centre line of pumps	Elev. 44.0
Floor of suction well	Elev. 38.0
Normal high water level in suction well	Elev. 53.5
Mean high water in Delaware River	Elev. 48.5
Mean low water in Delaware River	Elev. 42.8
Approximate present maximum of rate of dry weather flow of sewage into suction well per 24 hours	27,500,000 gal.
Approximate present average rate of dry weather flow of sewage into suction well per 24 hours	18,333,000 gal.
Approximate present minimum rate of dry weather flow of sewage into suction well per 24 hours	11,000,000 gal.

The suction well has a total area of approximately 1,050 sq. ft., and a depth at maximum sewage level of 16 ft., with a total volume of approximately 126,000 gal., equivalent to four minutes' pumping at the 46,000,000 gal. rate.

All pumps and motors are of the vertical type, a total of six pumps being provided in the station. Three of these are constant speed pumps, having a rated capacity of 8,000,000 gal. per day, and three are variable speed pumps, having a rated minimum capacity of 3,000,000 gal. per day, and a maximum capacity of 11,000,000 gal. per day, all against a constant head of 23 ft. The guaranteed efficiency of the 8,000,000 gal. and the 11,000,000 gal. per day pumps is 80 per cent at full capacity. The motors are of the vertical type, mounted on cast iron sub-bases. Three of these are for the constant speed pumps and are of the constant speed squirrel cage type, and the other three are for the variable speed pumps and are of the variable speed slip ring type, all motors operating on 2,200 volt, 3 phase, 60 cycle current. The switchboard is 30 ft., 4 in. long, the panels being placed on a tangent, with a 19 ft., 9 in. radius circle. All control and indicating apparatus is mounted on the switchboard, with automatic master control system mechanism mounted in the rear.

Office, fully equipped laboratory, locker and lavatory surround the motor room on the side opposite the switchboard. The heater, coal storage and general storage room and some of the electrical equipment are placed on the floor below the motor room above the suction chamber. The Venturi meter chamber is built against the exterior wall of the suction well and a door provided from the station for convenient access.

Grit Chamber Design.—As the sewers are of the combined storm and domestic type, it was necessary to provide grit chambers to intercept the grit carried to the plant during storm flows. The grit chambers are two in number, with stop planks at each end for individual control, and have an effective length of 60 ft. The cross section of the chambers is such as to provide an average velocity of 1 ft. per second. While it is possible to hydraulically design the chambers so as to obtain an actual velocity of 1 ft. per second throughout the entire depth and volume of flow, the structural difficulties usually involved are so great that a trapezoidal section is used and other means resorted to, to obtain the required results.

Orginally, the use of a Sutro weir was contemplated to effect this result. The design of this type of weir is such that the discharge over and through it is directly proportional to the head or depth over the weir and the area of the weir determined by the head. However, the use of this type of weir requires a free discharge or fall, equal to the height of the weir, with a consequent loss of head equal to this drop. A study was made of other means whereby the same results could be accomplished without any loss in head or increase in construction costs. When it was decided to vary the rate of pumping in accordance with the rate of flow, a means was then provided whereby the pump speed or capacity could be controlled by the elevation of the sewage in the grit chambers instead of being controlled by the depth in the pump suction well, as was required using a Sutro weir.

The hydraulics of the grit chamber were carefully computed with one and two chambers in service and the rate of pumping then established to obtain an average velocity of 1 ft. per second. The rate adopted gives an average of 1 ft. per second, with definite minimum and maximum limits falling within accepted velocity rates for efficient grit removal.

Method of Pumping.—From the grit chambers, the sewage flows into a suction well, circular in shape, inside of which is the pump dry well. Studies were made to ascertain the most economical method of pumping as applying to an Imhoff tank treatment plant. To secure maximum efficiency from an Imhoff or any other type of settling tank, the flow from the pumps should be steady and free from surges and irregularities of any kind, and rates between minimum and maximum obtained as gradually as possible, with no sudden fluctuations. On account of the depth of the pumping well, it was also important, in order to keep down the cost of the work, to use a comparatively small pump suction well. Consideration of these two essential factors necessitated pumping rates practically equal to the rate of flow to the plant, with a minimum lag between the rate of pumping and the rate of flow to minimize the size of the storage well.

There are two methods whereby the rate can be varied, first using constant speed pumps and throttling the discharge, and second, by using variable speed equipment, and a comparison of the efficiencies of the two methods soon demonstrated that varying speed equipment gave over all efficiencies much higher than obtained by throttling. To increase the overall efficiency of the pumping station, constant speed and capacity units were provided to carry the major portion of the pumping load, with variable speed pumps taking care of the variation between the capacity of the constant speed pumps and the rate of flow.

Centrifugal Pumps.—A total of six pumps have been provided, three constant speed and three variable speed. The constant speed pumps each have a capacity of 8,000,000 gal. per day, and the variable speed pumps each have a range in capacity between a minimum of 3,000,000 gal. per day and a maximum of 11,000,000 gal. per day. In order to eliminate inequalities in the rate of pumping by variations in head at the various stages of operation, the head should be practically constant over the entire range in pumping. Fortunately, at this plant, the design conditions were such that this balancing of heads was obtained. Increased friction head through the force main due to the increased rate of pumping, was practically compensated for by a decrease in the static head due to the increased depth of flow in the grit chamber. The total head against which the pumps operate is practically constant at 23 ft.

The pumps installed are of the double suction, vertical type, with vertical split casings. The three 8,000,000 gal. per day constant speed pumps operate at a speed of 490 R.P.M., and at a head of 23 ft. having an efficiency of 80 per cent. The variable capacity pumps, ranging from 3,000,000 gal. to 11,000,000 gal. per day at speeds ranging from 408 R.P.M. at the low capacity, to 490 R.P.M. at the high capacity, have an efficiency at the low capacity of approximately 56 per cent, to 80 per cent at the maximum capacity at a head of 23 ft.

The casings are constructed of cast iron having a shell thickness sufficient to withstand a hydrostatic pressure over ten times the actual operating pressure. Suction and discharge connections are 20 in. in diameter. Large handholes are provided for access to the impellers, and connection provided in the outer rim of the casings so that a stream of water can be impinged against the impeller and flush it out while the pump is in operation. Should it be necessary in an emergency to have full access to the impeller, one side of the casing can be quickly removed and any foreign matter jammed in the impeller can be easily and quickly removed, the casing replaced and the pump put back in service with a minimum delay. In addition to these provisions, the rotation of the pumps

is reversed several times a day, the sewage flowing backwards and flushing out the impeller.

A bar screen having 1 in. openings is provided at the entrance end of the grit chamber to remove solids which would have a tendency to clog the pump impellers. The impellers are of the enclosed type, as the capacity of the pumps is large enough so that ample space is provided through the impellers to pass any solids that will pass through the screens. The impellers are made of bronze, with bronze wearing rings having a spiral cutting thread machined in their periphery, the sharp edges of which cut any stringy or fibrous substances that may get into the rings and thus prevent them from clogging. The shafting is protected by stationary sleeves, which prevent rags, strings, etc., from wrapping around it, and is also encased in bronze sleeves extending from the impeller out through the stuffing boxes, to prevent wear by the boxes on the shaft itself.

The bearings are split vertically and constructed of cast iron with babbitt metal linings, with machined spiral oil grooves to force the oil through the bearing. The bearings are supported by cast iron bearing brackets bolted to the pump casings. The entire rotating element can be removed and replaced by lifting the casing cover and the bearing caps without disturbing any piping connections or motor connecting shafting.

Another feature of the pump and piping arrangement is the cleaning of the impeller with a reverse rotation of the shaft. By cutting off the current to the motor, the pump stops and sewage from the force main flows backward into the pump casing, reversing the rotation of the pump impeller, and discharges through the rim and impeller openings and flows back into the suction well, effectively removing any loosely lodged solids in the impeller. The discharge valve is then closed, the motor started and the discharge valve opened. This entire cleaning operation can be done within a period of five minutes and is a part of the daily routine of the operating force, the rotation of the pumps being reversed three or four times daily. Every known factor to eliminate clogging and to clean the pumps was adopted in the design of the pump unit.

In view of the fact that the entire operation of the pumps is practically automatic with three constant speed and two variable speed units, it was necessary that the complete characteristics of the pumps be ascertained before the motor manufacturer could design the motors and the control mechanism. Therefore, the pump builder before manufacturing the pumps had to submit data on the anticipated performance of the pumps, and from these data the control equipment of the motors was designed. In view of the exacting requirements and the importance of having correct information covering the operation of the pumps, extensive and complete shop tests were run on the entire six pumps to check the anticipated requirements. The results of these tests checked very closely, the proposed characteristics requiring very little change in the actual design of the control equipment. The tests were very carefully made, the head being read by calibrated piezometer tubes, the quantity measured through a calibrated Venturi meter and the power input being obtained from a calibrated direct current motor, using calibrated voltmeters and ammeters.

Connecting Shafting.—As the pumps are set in the bottom of the pit and the motors placed on the operating floor approximately 30 ft. above the pumps, it was necessary to provide connecting shafting between the pumps and the motors. Several special features in the design of the connecting shafting and bearings are well worth bringing out. Unit suspension is provided for all pumps, that is, separate thrust bearings are provided for the motor, the connecting shafting and the pump, and are set up and aligned separately. With this arrangement, it is impossible to overload any unit and more flexibility is obtained than if the entire thrust and steady bearing and two alignment bearings are provided for each shaft.

The combined thrust and steady bearing is of a special type developed for this installation. It consists of a babbitted journal bearing to take the side thrust, and a special ball bearing to take the thrust. The entire bearing is self-contained and supported on the floor casting, which is extended to receive the motor supporting base, assuring correct alignment of the motor and bearing. The radial bearing is constructed of cast iron with babbitt metal lining, spiral grooved to force oil to all parts of the bearing. The bearing is spherically shaped and is supported by a cast iron frame spherically recessed to suit the bearing. Any swaying of the shaft is taken up in the ball without injury to the bearing lining. The thrust is taken up by a ball bearing, the washer of which is radiused from the centre line of the radial bearing. Adjustment is provided by a thrust nut provided with jam bolts. An oil level bushing keeps the ball bearing always submerged in oil. Oil from the bearing is taken off by a cast iron oil slinger attached to the shaft, which throws the oil against a tight baffle into the oil pan.

The two alignment bearings are similar to the thrust bearing except that the ball bearing and the thrust housing were eliminated, the cast iron bearing frame bolting directly to a floor casting. All bearings and frames are split for convenience in assembling and repairs. A flexible coupling is provided at the motor and pump shafts, making the connecting shaft an entirely separate unit.

Oiling System.—The oiling system for the six pumping units is of the force feed type, with continuous feed of filtered oil. The oil filter is of the continuous operation type, having vertical filtering units and tray precipitating compartments, all parts of which are removable. The dirty oil is discharged into the top of the filter, all moisture and foreign matter removed, and is discharged into a compartment in the bottom of the filter tank. From here it flows into a multiple sight feed oiler, attached to each motor sub-base. Separate pipe connections are carried to each bearing on the connecting shaft and the pump, discharging into the top of the bearing and out through the oil pan into a common oil discharge pipe, which discharges into a pipe container placed at each pump. A gear type oil pump is attached to the bottom of each pump shaft, taking its suction from the oil container and discharging into the oil filter. Each unit has, therefore, a separate oiling system and the amount of oil filtered depends on the number of pump units in operation. All possible means were taken to obtain a free, uninterrupted flow of clear oil and to make it as nearly fool-proof as possible.

Piping and Valves.—Each pump has a separate suction connection, terminating in a bell mouth elbow pointing downward. A valve is provided between the pump suction and the suction well, which is operated from the first landing by an indicating type floor stand. Each pair of pumps discharges into a common header, which is manifolded for the three pairs of pumps into a 54 in. cast iron force main leading to the Venturi meter. With this arrangement, all the discharge piping is centralized in the centre of the station and provides ample room around all parts for inspection and repair.

The discharge valve on each pump is of the hydraulically operated type, controlled from a panel mounted on the operating floor. Lights to indicate the open and closed positions of the gate valves are mounted on the control panel adjacent to the valve control handles, enabling the operator to visualize the position of all gate valves from a central point. No check valves are provided on any of the discharge connections, the hydraulically operated gate valve taking the place of the usual check and gate valve arrangement. When a pump unit is thrown out of service, the gate valve on the particular unit is closed by a movement of the control lever.

Venturi Meter.—The Venturi meter tube is placed in a concrete chamber built adjoining the exterior of the suction well. The tube is constructed of cast iron and concrete with a 54 in. diameter upstream body, a 24 in. diameter throat and 30 in. diameter at the point where it joins the concrete section of the tube. The total length of the meter is approximately 22 ft. 6 in. The body pressure belt is provided with

two handholes and four cleaning valves, so that the bushings can be kept clean, also two clear water flushing connections. The throat is bronze lined and the pressure belt provided with the same accessories as the body belt. The throat and body piezometer or pressure lines are placed on an upward grade to two 4 in. piezometer tubes placed close by the mercury cylinder. An orifice is placed over each of these tubes to admit a small stream of clean water, causing a slight reverse flow, thereby eliminating to a large extent the introduction of any sewage solids to the registering mechanism. The piezometer tubes also function as collectors for any sewage solids admitted and are periodically blown off. The pressure in the piezometer tubes is transmitted to the mercury in the cylinder and through a hard rubber float to the register placed directly above. All possible means were taken to insure continuous accurate operation of the apparatus and freedom from clogging.

Motors.—The motors operating the six pumps are all of the alternating current type, operating on 2,200 volt, 3 phase, 60 cycle current. The motors were designed to meet the pump conditions. The motors operating the constant speed and capacity pumps are of the vertical squirrel cage induction type, having a capacity of 50 H. P. at a 40 deg. C. rating. The brake horse power of the pumps which these motors operate is 40, plus about 2 H. P. for shafting and bearings, making a total of 42 brake horse power. The motors operating the three variable speed pumps are of the vertical slip ring wound rotor type, having a capacity of 60 H. P. at a 40 deg. C. rating. The maximum brake horse power of the pumps which these motors operate is 56, plus approximately 2 H. P. for shafting and bearing losses, making a total of 58 brake horse power. Both types of motors have 14 poles, and a synchronous speed of 514 R.P.M., with a full load speed of 490 R.P.M.

The variable speed motors are of the bracket type, of rugged design to withstand the shocks imposed by heavy duty service. The stator frame is of cast iron and is designed to give strength and rigidity where most needed. Frame openings are large and of such construction as to secure the most efficient air flow for ventilation. The rotor is built up on a rugged cast spider with the laminations keyed to the spider and held in place between heavy end plates. The collector rings are shrunk on an insulated sleeve, which is pressed onto the shaft, preventing the parts from becoming loose and enabling the collector to be removed from the shaft as a unit without disturbing the individual rings. The cores are provided with radial air ducts placed at frequent intervals, through which the cooling air is forced by the centrifugal action of the rotor. Fans on each end of the rotor force cool air through and around the ends of the coils and out through the openings in the frame. The brackets are cast iron and of liberal section to give ample strength. The upper bearing is a combined thrust and radial ball bearing, and the lower bearing is of the babbitted sleeve type. Both bearings are automatically lubricated.

The construction of the constant speed or squirrel cage induction type motors, stators, brackets, bearings, shaft and rotor, except the winding, is generally the same as described for the variable speed motors. The motor winding consists of copper bars driven into partially closed rotor slots, the ends of these electrically brazed to the resistance rings, giving a very simple, substantial and trouble-proof winding.

The variable speed motors have a guaranteed efficiency of 86 per cent and 71 per cent power factor at full load speed, and the constant speed motors a guaranteed efficiency of 85 per cent and 68 per cent power factor at full load speed. The motors were fully tested in the shops prior to shipment to check the guaranteed efficiencies at the various speeds required in the pumping range.

Control Equipment. — The control equipment consists of a twelve panel switchboard, three automatic starters for the constant speed motors and a master controller, with valve and gauge panels mounted adjacent thereto. The panels are 90 in. high, mounted on 1¼ in. pipe frame and 2 in. x 6 in. Channel iron base. Slate is 2 in. thick, with ¼ in. bevels on front edges and provided with a black marine finish.

The automatic starters for the constant or squirrel cage motors are mounted separately below the operating floor on slate panels 40 in. wide x 90 in. high. Operation of these starters is by push button stations.

Master Controller.—The master controller controls the starting, speeding up and slowing down and stopping of any or all of the three constant speed pumps and any or two of the three variable speed pumps over a range in pumping from a minimum rate of 8,000,000 gal. to a maximum rate of 46,000,000 gal. per day. The control system is of the semi-automatic type and is so designed that the rate of pumping conforms automatically to the rate of inflow of sewage into the suction well, the sewage being automatically pumped out as fast as it flows into the suction well, with the requisite pump capacity and speed of pumps in service required therefor maintained at all times, making impossible either the overhauling or the inflow by the pumps so as to drop the level in the grit chambers below Elev. 48.8, the overhauling of the inflow by the pumps so as to allow the level of the sewage in the grit chambers to rise above Elev. 53.5. This result is accomplished without intermittent operation involved in the stopping of all pumps for even very short periods.

The float mechanism is connected by a chain operating over ball bearing sheaves to a sprocket. At every 1 in. increase in level of the sewage in the float chamber the sprocket turns, driving the notching mechanism, making contact, which energizes a pilot motor, causing a contact making device to move horizontally one step and make contact with one of the fingers that bears on the drum. At the same time, the device resets for the next step. As soon as the drum finger is energized a second pilot motor causes this drum to turn until the finger comes to an insulating strip, when the motor stops. Attached to this drum is a shaft, carrying the clutches for connecting in the drum controllers. The contact making device, driven by the first pilot motor referred to, advances from left to right for increasing levels, and from right to left for decreasing levels, picking up one contact at a time and energizing a correspondingly numbered finger on the drum. The drum is in two sections, with an insulating strip between. Therefore, whenever a finger is energized, the drum will turn until the finger comes to the insulation strip, and as each succeeding finger is energized, the drum moves one inch. The drum provides for seventeen points, any one of which can be used, depending on what finger is connected to the contact segments of the sequence switches. Therefore, if it is desired to change the pump speed at certain elevations different from what the control was originally laid out, it is only necessary to change the finger to which the contact segment is connected and not necessary to change the drum insulation strips. The master controller is caused to function by means of a float placed in a cast iron pipe float well. This float well consists of a 30 in. diameter cast iron pipe extending from the bottom of the suction well to a point flush with the operating floor. A 4 in. cast iron pipe is extended from the float tube to the upstream end of the grit chamber, terminating in a 6 in. tee placed vertically at one side of the grit chamber, at the top of which is provided a clear water connection with a needle valve, through which a small stream of water flows, preventing any solids flowing into the connecting pipe. In addition to this, several small sprays are placed at the top of the float tube with needle regulating valves, through which small streams of water are sprayed on the pipe, causing a slight reverse movement of the water through the connecting pipe. Blowoffs, etc., are provided in the bottom of the tube for flushing out any accumulated solids. A copper float is suspended in this float tube, the movement of which is transmitted by a chain to a sprocket wheel, which causes contacts at the primary motor to close momentarily and then open. The mechanism is so designed that these contacts will be closed for every one inch change in sewage level in the pump well. The closing of these contacts causes the notching mechanism

to take one step, energizing the fingers and thus starting the pilot motor and rotating the pilot drum and any secondary drum controllers that happen to be clutched into the drive shaft. The notching mechanism also makes contacts at proper levels to indicate to the operator when to start or stop additional pumps, by lighting lamps and ringing alarms.

Miscellaneous Panels.—To secure centralized control and observation of the performance of all the equipment, additional panels were mounted alongside the switchboard. The construction and appearance of these panels is identical to the electrical panels and forms complete panel board controlling all functions of the station.

Overall Efficiency of Pumps and Motors.—On designs of this particular type, incorporating variable speed pumps and motors, the overall pumping efficiency very often is sacrificed to obtain good settling tank efficiency. For this plant, a particular effort was made to obtain efficiencies which would approximate those obtained by the use of constant speed pumps and motors operating under full load conditions. Various combinations and methods of pump operation were carefully studied and computations made covering overall pump and motor efficiencies at the rates established for the typical day flow. The method of pumping finally adopted, using constant and variable speed pumps and motors, proved the simplest and most economical. With this combination, the major portion of the pumping load is taken care of by the constant speed pumps and motors, operating at maximum load and efficiency. The variation in flow above the capacity of the constant speed pumping units is taken care of by the variable speed pumping units. The constant speed pumping units pump 60 per cent of the daily flow, and the variable speed pumping units pump 40 per cent of the daily flow. The overall efficiency of the constant speed pumping units can be readily ascertained, but variable pump and motor efficiencies are introduced by the variable speed pumps and motors, which add complications.

The electric current is purchased from the Public Service Gas & Electric Company and is supplied at 4,400 volts and stepped down through transformer to the voltage used by the motors. The cost of electric current based on the typical day flow is as follows:

K. W. H. per day	2,400
K. W. H. per month	72,000
Maximum demand	210 K. W.
Million gallons pumped	22.2 per day
Million gallons pumped	666 per month

Demand Charge.—The demand or primary charge paid for each month is $1.50 per horse power for the maximum demand in such month up to and including 200 H. P.; $1.35 per horse power of the excess maximum demand in such month over 200 H. P. up to and including 400 H. P. This demand charge is as follows:

Demand 210 K. W. = 282 H. P.	
200 H. P. @ $1.50 per H. P.	$300.00
82 H. P. @ $1.35 per H. P.	110.70
	$410.70

Consumption Charge.—In addition to the primary or demand charge, a secondary charge is made for the electrical energy furnished as measured by a meter placed on the switchboard as follows:

3 ct. per K. W. H. for the consumption in such month up to and including 3,000 K. W. H.
2 ct. per K. W. H. for the excess consumption in such month over 3,000 K. W. H., up to and including 10,000 K. W. H.
1 ct. per K. W. H. for the excess consumption in such month over 10,000 K. W. H.

This secondary charge is as follows:

Total K. W. H. per month — 72,000		
3,000 K. W. H. at 3 ct.	$	90.00
7,000 K. W. H. at 2 ct.		140.00
62,000 K. W. H. at 1 ct.		620.00
	$	850.00
		410.70
Total		$1,260.70

The average cost per K. W. H. on the above basis is 1.75 ct.

The cost of electric current per million gallons of sewage pumped is $1.91.

The designing engineer, who also supervised the construction, was Col. George L. Watson. Abram Swan, Commissioner of Public Works; A. C. Gregory, Engineer of Water and Sewers, and the writer (from May, 1926), acted for the city of Trenton in the supervision of construction. The plant took approximately two years to build, being started in May, 1925. The cost totaled $1,243,000.00.

New Flood Proof Sewage Pumping Station Announced

It is generally admitted that electric motors and controlling devices used to operate sewage pumps should never, unless absolutely necessary, be located in underground chambers or vaults where they may be injured by excessive dampness and lack of attention. In some localities, however, because of the inability of the municipality to secure the necessary property adjacent to sewer lines for the construction of a housing above the surface for electrical equipment, the installation of motors and controllers under ground cannot be obviated.

In such cases there is not only the possibility of damage from condensation and lack of ventilation in the vault, but also of complete submergence of the equipment under flood conditions, and the new Yeomans flood proof underground pumping station (patented) has been designed to prevent the complete filling up of such an underground chamber under any conditions that are likely to occur.

As shown in the accompanying diagram the unique feature of this station is that, owing to the steel drum which forms the entrance to the chamber and extends down to a point considerably below the level of the electrical equipment, the motors and controllers are located in an air-locked space in the upper part of the chamber, and even with a considerable head of water over the top of the chamber and with the cover removed from the entrance manhole, the water in the chamber cannot rise far enough above the bottom of the entrance drum to reach the motor windings or electrical devices or connections.

The power wires for the motor are brought in through the steel wall of the chamber with stuffing boxes, and the ventilating pipes, if any, are carried down to the same level as the entrance drum so that air cannot escape at any point above this level. The pit drain valve, which is connected to the suction of the sewage pump, is provided with an extension stem running up into the entrance drum, so that after flood conditions have subsided the water remaining in the chamber can be pumped out even though it may be impossible to gain access to the pit.

This flood proof principle is applicable for use with sewage ejectors and emergency pumps in municipal and city building work to protect controllers and motors driving pumps wherever flood conditions are likely to occur. Yeomans Brothers Co. is located at 1423 Dayton St., Chicago.

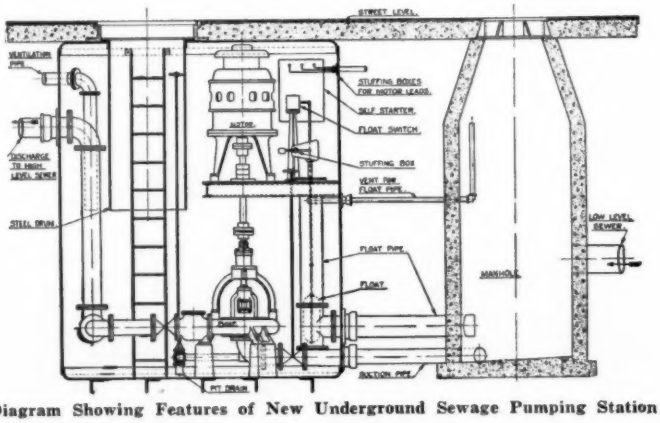


Diagram Showing Features of New Underground Sewage Pumping Station

Volunteer Fire Department at Alliance, Nebraska

This City Investigated Carefully Before Purchasing Additional Fire Apparatus for a Volunteer Department Described in Kansas Municipalities

By L. A. GOINES
City Manager, Alliance, Nebraska

The problem of adequate fire protection for the small municipality presents difficulties that are not encountered in a metropolitan city with its highly developed fire fighting organization, greater experience and less limited financial resources. The smaller place, usually depends, of necessity upon a volunteer department and its administrative head seldom has at his command a sufficient knowledge of the subject, with its myriad-semi-technical details, to enable him to approach and handle it intelligently. The problem itself is fundamentally the same in all communities, whether it be in a tiny crossroads hamlet or in a city of a million inhabitants, and resolves itself into two natural phases, viz.,

1. Fire Prevention
2. Fire Fighting

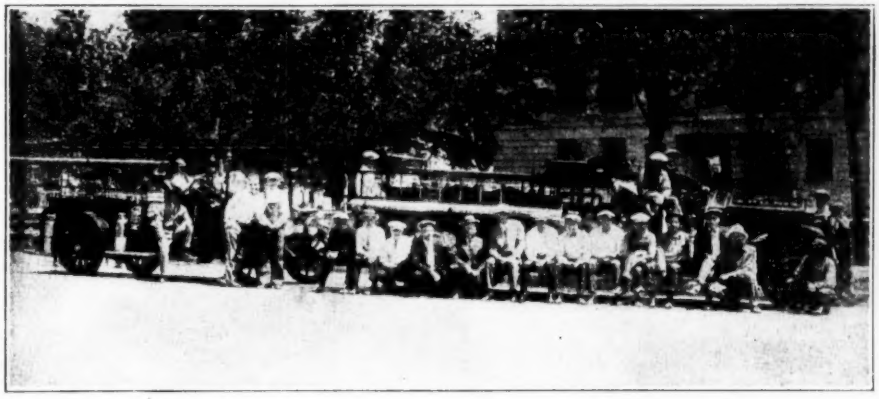
Of the two, the former—FIRE PREVENTION—is by far the more important. The old moss grown adage anent "An ounce of Prevention, etc." has no truer application anywhere in the entire fabric of our social life than right here. It is always easier and less costly to FIGHT FIRES BEFORE THEY ARE LIGHTED than after the blaze is started. From a purely dollar and cents viewpoint, money spent in preventing fires always saves itself many times and, no matter how efficiently a fire fighting organization may function, no matter how quickly the conflagration may be extinguished, there is always an accompanying economic waste that insurance cannot cover nor act of man recover. Loss of time, expenditure of energy, interruption of the pursuit of regular activities, frequent endangering of life and limb—all these and many more intangible, but none the less real losses are suffered by someone, somewhere, every time a fire is permitted to break out.

For the past year, the City of Alliance, (pop. 4,591, 1920 census), has been working on a well-defined program of fire protection, and while there still remains a great deal more to be accomplished, the results have already begun to show as being worth the effort.

Preventive Measures and Water Supply.—The first step was to comply as fully as possible with the recommendations of the Nebraska Inspection Bureau, which have the dual purpose of reducing fire hazards and reducing insurance rates. From time to time additional improvements have suggested themselves and have been acted upon, always, however, with the approval of the Bureau. The reason for close cooperation with the Bureau will be obvious to anyone who has ever tried to bring about a general reduction of rates. An outline of these preventive measures follows:

Provide complete records in book form showing the daily consumption of water; also compile detailed maps and records of the system showing the sizes and locations of all valves, mains and hydrants; keep same corrected to date. These are checked quarterly and sometimes more often.

Connect up all "dead ends" with not less than 6" pipe wherever and whenever possible.



Members of Alliance Volunteer Fire Department and Their Apparatus

When additional hydrants are connected to the system allow a maximum of not to exceed 85,000 square feet of area to be served in the mercantile section (fire district) and 100,000 square feet in the residence section. Six new hydrants added so far bringing total to 93.

Inspect all gate valves periodically and keep record of condition of same and make any necessary repairs and adjustments immediately. This is done quarterly.

Increase the water supply. The supply is pumped from five wells varying in depth from 110 feet to 160 feet, into a 500,000 gallon covered concrete reservoir and thence pumped by a steam pressure pump of 1000 g.p.m. capacity into the standpipe. The total combined maximum of these units is 1.72 m.g.d. with all units working full time and the pressure pump carrying a slight overload. To augment the supply thus obtained and at the same time provide something like reasonable protection in standby units a 25" Kelly Well was put down early this spring. Total depth 142 feet, with a water depth of 100 feet. On test with a Gregg pump this well developed 292 g.p.m. with a draw down of only 8.5 feet, or an estimated capacity of 2260 g.p.m. This means a potential increase of 3.25 m.g.d. However, there is no need at present and perhaps will not be for a few years to pump, it to anything like capacity, hence it is being equipped with an American Deep Well Turbine of 1500 g.p.m. capacity. On a basis of sixteen hours operation out of twenty-four, this will give a net increase in supply of 1.44 m.g.d leaving about 35% capacity for reserve should it ever be needed in the future. On a recent test this pump delivered 1677 g.p.m. or 11.8 per cent in excess of its rated capacity. There is also being installed a 6" American Horizontal Turbine pressure pump of 1000 g.p.m capacity for pumping into the standpipe. These new units are all electrically operated.

Interesting the Public.—A member of the volunteer fire department was appointed as fire inspector and was given a commission as deputy state fire marshal which gives him ample authority. His inspections thus far have been confined to the business district, public buildings and schools. With the owner or tenant he makes a complete "Fire Prevention" inspection from cellar to garret, making note of all undesirable conditions with suggested remedy therefor. This report is made in duplicate, one copy being given to the occupant or owner of the building and the other retained by the inspector for check-up on his next monthly inspection. The public has responded admirably, with the result that a great many bad conditions have been uncovered and corrected. Thirty additional 2½ gallon acid and soda tanks and 16 1-quart tetrachloride extinguishers have been

installed and 39 refilled that were found empty or unusable.

An amply supply of acid and soda has been placed at the fire station for the re-charging without cost, of all extinguishers that are brought in. At every fire where extinguishers are used other than those belonging to the fire department, the chief details a man to see that such extinguishers are immediately brought in and refilled.

The department secured Harry K. Rogers, known nationally as the "Fire Clown" during the Annual State Firemen's Convention here in January. Through a series of meetings at the school houses and at one of the theaters, held especially for school children, Mr. Rogers made "Fire Prevention Inspectors" of hundreds of little ones to whom a leaky flue or the careless throwing away of a lighted cigarette had previously meant nothing.

The fire department, the police department, the health department and in fact the entire personnel of the city administration has combined to FIGHT FIRES BEFORE THEY ARE LIGHTED. A determined effort is being made to make this a perpetual campaign and keep it before the people all the time.

Fire Fighting Apparatus.—For several years the fire fighting apparatus has consisted of a combination chemical and hose automobile truck, two hand reels and a 40 foot extension ladder. The last named was seldom used because there was no way of carrying it to a fire. The expansion of the city by reason of several additions to the corporation limits since the purchase of the original truck, together with the natural growth of the community, made the purchase of another unit of motorized apparatus a necessity. The city manager was instructed early last summer to buy another truck.

Now a city manager is supposed to be posted on a great many subjects, particularly in a town of less than ten thousand inhabitants, where his contacts with detail work are so much closer than in the larger places. However, the relative merits of all the different types of fire trucks that are offered for sale in the United States, was one subject upon which neither he nor any of his official associates were even reasonably well informed. The only thing to do was to go to those who were informed from actual experience, for the necessary information. The first step was to send out a questionnaire to fire chiefs in different parts of the country. This questionnaire consisted of eleven questions, concerning the type, capacity, and number of units of equipment used; water supply and main pressure; operating conditions; contained a brief statement of our local conditions as to water system, pressure, type of building construction, area to be served, population, street conditions, etc., with a request for both general and specific suggestions.

Analysis of Replies.—This was mailed to the fire chief of every town of more than 5000 inhabitants (except metropolitan cities), in Nebraska, Kansas, North Dakota, South Dakota, Montana, Wyoming, Colorado, Utah, Nevada, Washington, Oregon, Idaho and New Mexico, with scattered inquiries to similar towns in 12 other states. Replies were received 78 per cent of the total number addressed. Forty-one chiefs wrote personal letters giving additional information. Sixteen per cent have full paid departments; 84 per cent have volunteer departments, (though more than 60 per cent of the latter pay their volunteer firemen from 50c to $1.50 per hour for actual service). Whilet he replies confirmed the statements made by most of the apparatus salesmen in that approximately 85 per cent of all the fires are extinguished by use of chemicals alone, 89 per cent of these replying recommended the purchase of a triple combination truck, in most cases suggesting one of 750 g.p.m. capacity.

The city manager arranged to visit eleven of the cities from which replies were received, when taking his annual vacation, and examined as many different makes of equipment, secured a great deal of valuable information first hand concerning them and the companies selling and servicing them. After this the city was able to deal with salesmen more intelligently and to eliminate at the outset, many whose equipment was not suitable. The factors governing the final selection were: (1) quality, which included suitability of the machine to local conditions; (2) responsibility of the manufacturers; (3) cost. The result was the purchase of a 600 g.p.m. pumper of the rotary type, 100 h.p., 196" wheelbase, provided with 2 35-gallon chemicals, 1600 feet capacity hose bed and the usual complement of ladders, hand chemicals, other accessories, Pierce-Arrow chassis with Boyer equipment. It is only fair to say that it was quite difficult to make a selection from among the three or four high grade pieces of apparatus, to which the choice was narrowed down at the end. These machines were uniformly good; the companies behind them were responsible, and there was not a material difference in the cost.

The old truck was overhauled and repainted, and the 40' extension ladder mounted overhead, making a serviceable second unit of it. Minor equipment such as smoke masks, electric lanterns, boots, rubber coats, etc., was brought up to standard requirements and will be added to from time to time as needed.

Fire Department.—With the exception of a paid truck driver, who is on duty all the time, the department is entirely voluntary. It consists of four companies, of twenty men each. Under the direction of the chief, drills are held regularly each Sunday, with occasional mid-week drills in conjunction with the fire department of the Burlington railroad shops. Four men in addition to the fire truck driver sleep in the fire station. There were 38 alarms answered in 1925, with an average attendance of 23 firemen; total damage, $5495, all of which was covered by insurance.

Village Planning Big Factor in Community Life

City planning as practiced in metropolitan centers has its counterpart in the development of villages that serve as social and trade centers for farming communities. The automobile affords the farmer a wider range of choice in selecting his recreation and in selling his products and buying supplies. Some of the elements of good physical makeup of towns and villages, according to Wayne C. Nason, of the Division of Farm Population and Rural Life of the Department of Agriculture, are convenient and pleasing exits and entrances, broad tree-lined streets, a common or village green as a civic center, park and playground space, sanitation, good architecture in private dwellings, as well as in public buildings, which should be conveniently located, and all set back from the streets and surrounded with ample lawns and clean and attractive borders. Villages that do not minister to the needs of the farming communities are likely to complain of the drift to the cities and of ruinous competition. Villages that are attractive, as well as serviceable, also profit from the ever-increasing army of summer tourists.

Preventive planning, which foresees and prevents expensive mistakes in building, is recommended to village communities. As in the cities, rebuilding after a bad start may be expensive but cheaper in the long run. Exceptional new villages planned recently, with an eye to the future, include Mariemont, Ohio; Longview, Wash.; Pinehurst, N. C.; and Palo Verde, Calif. Other villages are rebuilding either in large-piece reconstruction work at one time or by adoption of long-term plans for replacement of undesirable buildings as they wear out. The movement is country wide and supported by planning associations and boards in several states. A long list of towns and villages which have initiated planning practices includes such scattered communities as Weston, Mass.; Leroy, Ohio; Forrest City, N. C.; Cape Girardeau, Mo.; Post, Tex.; Pipestone, Minn.; Logan, Utah; and Durham and Patterson, Calif. Mr. Nason concludes that village planning is in its infancy. It represents not a waste but a saving of money in forestalling the need to spend great sums in the future for reconstruction and in providing for the economic, social and esthetic welfare of the 20,000,000 people who live in villages or small towns and of the 30,000,000 farm people who use them.

Costs, Accounting and Records

Practice of Dallas, Tex., Water Works Outlined in Paper Read at Texas Short Course Water School

By W. H. DEATON

In attempting to discuss costs, you are forced to consider the entire outlay of moneys used in operating the plant and must of necessity consider extensions and improvements. Improvements made wisely will save you more money in operating your plant and maintaining it, than any budget system you can conceive after the extension has been improperly made. The word Costs usually means Cut Costs. Farsightedness and anticipating what will happen in the future are material benefits. Anticipate as nearly as possible what a 10-year period will bring and then make your extensions accordingly. Systematize your fire protection and distribution of water mains, so that in the near future it will not be necessary to take out a small water main and put in a large one or have to put in a fire plug in a line already laid.

Proper spacing of valves is a matter that has never been given proper attention until the past few years. The proper spacing of valves makes it possible to repair a leak with the least inconvenience to your consumers, and makes you able to cut the water off in the least possible time and in this way curtails the loss of much water that costs you just as much money to filter and put in the water mains as any that you sell.

The Value of Meters.—This brings to mind waste water. In water systems that are not metered, if a fair charge is made for water actually consumed by your consumer, you are headed for the rocks just as surely as water will flow down hill. For in ten cases out of nine your consumer who is not metered will waste twice as much water as he consumes or pays you for. It costs considerable money to meter a water system, but it costs you considerably more to keep water in your mains where it is not metered, than it does to meter all of your services. Our experience in Waco is the rule rather than the exception in those cases. The installation of about 2,500 meters in our city in the early part of 1924, bringing our system up to bout 99½ per cent metered, has cut our pumpage about 10 per cent, and increased our revenue about 5 per cent. Costs in running a water plant are only to be considered in this way.

If you are getting something that is worth the money and then some, it is a wise investment. The point I wish to make is, don't be a back number just because it costs money to put into effect modern ideas, for they nearly always pay.

Separation of City Government and Water Works Department.—It is my opinion that a city government and its waterworks should absolutely be divorced, as it is in our city. The city of Waco pays the Waco city waterworks for all water used, just like an individual. The waterworks in turn pays the city for everything they get from them, including the interest on outstanding bonds issued for the purchase of the waterworks, while the city pays the sinking fund. This arrangement divides the burden between the property owner and water consumers.

We have our board of water commissioners elected by the people, and this board in turn elects a superintendent and secretary who have charge of the waterworks and its finances. They know where the money comes from and where it should be spent. The city has no more to do with running the waterworks plant than any private citizen. They can't spend our money, and for that reason we don't need any of their money. The superintendent and waterworks commissioners can't paddle their own canoe unless they have one of their own to paddle, and if they have the canoe and the paddle is at the city hall in the office of the mayor and the city commission, they are still out of luck. If you have to explain to the mayor, all of the city commissioners and all of the politicians in the city just what you propose to do and how you intend doing it, you won't ever get anywhere. The reason is they are not experienced waterworks men.

The Superintendent. — The costs of running a waterworks are made what they should be largely through the ability of the superintendent. He must be either especially educated for that kind of work or must be one of those fellows that started at the ground and through hard work and applying himself has come from the ground up. In either case both must be endowed with that God given good old sound common sense, and with the ability to put himself in the place of any of his consumers or the place of an employe. His conduct must be such that he will radiate the idea (You understand I am talking about a municipally owned waterworks) that this is your water plant just as well as anyone else and is here to serve you.

In the waterworks game the co-operation received from your employes will make or break you, and this to a very great degree will determine your costs. It is not always that thing that you are spending your money for that is eating up your profits, but the thing that you already have and have to run. What you get with the money spent is what counts. In this connection, long time employment of assistants is a factor not to be overlooked. If they are made of the right kind of stuff, the longer they are with you the more efficient they will naturally become. This is especially true of your chief engineer and filter plant operator. If you will tell me what superintendent of a waterworks has the best corps of assistants, especially chief engineer, (for on his shoulders rests a burden as great as that of any superintendent) I will tell you who is the most successful superintendent.

Water Works Accounting.—Accounting in a waterworks is only a system of keeping accounts and ascertaining at all times just what your financial status is. The most important factor in your accounting system is the keeping of your individual accounts. Our method in Waco is to collect our accounts every 30 days. We read every meter in our city every 30 days, beginning on the first day of the month and reading meters every day in the month completing the readings the last day of the month. The readings are turned in daily and billed as soon after reading as possible making bills due every day in the month. This makes your receipts uniform. Our bills are made on governmental postal cards that cost one cent each and the printing on the cards costs one dollar per thousand. The card shows the water rate in its entirety. Our minimum rate being $0.75 for 2,000 gal. and a gradual scale up to 20,000 gal. The rate being 10c per thousand for all above 20,000 gal.

Billing and Collecting.—Bills are due 10 days from date they are mailed and the notation of due date is stamped on the face of the bill. In the event the bill is not paid on the date they are due, a notice is mailed the customer giving him another five days in which to pay the bill. Record is kept also of this notice. If the bill still remains unpaid a cutoff ticket is made and unless the bill is paid immediately the water is cut off and a penalty of $1.00 is charged to re-connect. Our cutoffs are not very numerous due to the fact that we require deposits on meters, where party does not own the property served, sufficient to cover two months water bills. These customer accounts are so closely watched that in the year 1926 after doing $242,000 business, we had due and unpaid bills of $640. with our net gain for the year of $67,000. No charge is made for connecting and dis-connecting. We also think it unwise for a waterworks to have a collector and recognize only receipts made by a machine that can not be duplicated and this machine kept in the office. The use of the most modern devices such as cash registers, billing machines, name cutting machines and addressographs play an important part in our office and save much valuable time as well as adding efficiency.

Water Works Records. — Your records are prime factors of success and are indispensible. With the proper

records a waterworks could be run and past records could be referred to and the system carried on without interruption. Your records are sacred trusts that concern every individual and corporation within the bounds of your city. These records properly perpetuated can be construed by anyone and continued. The record of the setting of a water meter alone when properly recorded and in such shape that it can be carried on indefinitely requires about eleven different entries. This record enables you to locate this meter at any time. Tells you all of the different locations it has been used, the number of times repaired, etc. In other words your meter record properly treated would be entitled biography of a water meter. Your record of water mains, valves, fire plugs, etc., should be treated in a like manner. The most important items of this record being size, kind and location giving distance from known fixed points where they can be located by the use of a tape line. This information recorded on a map drawn to scale will save your consumers an inestimable amount of money, due to the fact that plumbing jobs can be figured rather than estimated, and your maintenance done at the least possible cost.

Sewage Disposal and Water Purification

Examples of Their Coordination Given in a Paper Presented Before Illinois Section of American Water Works Association

By PAUL HANSEN

Of Pearse, Greeley & Hansen, Hydraulic and Sanitary Engineer, Chicago

This country exhibits a wide range of river conditions with reference to sewage disposal and water purification. In some cases, as along the Ohio River, there is very little sewage treatment and the water filtration plants have been able to purify the sewage, in some cases with the assistance of liquid chlorine, in spite of the relatively heavy pollution load. In other cases, as for some of the smaller towns in the vicinity of New York City and Newark, N. J., the most complete sewage treatment works are necessary in order to protect water supplies which are purified only by chlorination without filtration. Of particular interest is the situation in northern New Jersey where the available quantity of water is already causing some concern with reference to the actual support of the probable future population. Having in mind such a wide range in stream pollution situations it appears of interest to briefly state a few typical situations which have come within our practice.

Portsmouth, Ohio.—Portsmouth, Ohio, is located on the Ohio River between Pittsburgh and Cincinnati. It has a population of about 40,000 spread along a river frontage of some six miles. The water works intake is located about two miles up-stream of the down-stream city limits. There is a district of some 3,000 people located in the extreme up-stream portion of the city for which it was extremely difficult to build an intercepting sewer discharging below the water works intake. A sewage treatment plant was therefore built comprising Imhoff tanks, contact tanks and liquid chlorine apparatus for disinfecting the sewage. This plant was built some few years ago with the approval of the State Department of Health. It is operated by the superintendent of the water filtration plant.

North Shore Sanitary District.—The North Shore Sanitary District includes the water front of Lake Michigan from Cook County north to the Wisconsin state line, a distance of about 30 miles. Practically all the communities within this district take their water supply from Lake Michigan at distances generally less than one mile from shore. Part of the sewage is drained into the lake. At the various outlets sewage treatment plants have been built providing for clarification and disinfection of the sewage with liquid chlorine. The plants so far constructed serve relatively small populations at Waukegan, Lake Bluff, Lake Forest and Highland Park. In these plants, in general, space has been provided for more complete treatment should that be desired in the future. Consideration is also being given to more complete treatment for the larger centers of population comprising the chief sources of sewage pollution in the lake.

Springfield, Illinois.—The Springfield Sanitary District have under construction intercepting sewers along the east and west margins of Springfield for collecting the sewage and delivering it to a site northwest of the city for treatment. There is also under consideration a water impounding project including a large lake northeasterly of the city. The east side interceptor therefore had to be planned with reference to the protection of this lake as a future water supply. All of the Springfield sewers are on the combined plan. It was therefore planned to intercept from the existing combined sewers all sewage up to a rate of 2,125 gal. per capita per 24 hours from the future estimated population and to deliver it to one point for treatment. At this point the first 300 gal. per capita will be pumped to the main sewage treatment plant. The remaining sewage over the above 300 gal. per capita will be discharged into the head waters of the lake some 11 miles above the proposed intake and provisions will be made for chlorination should a water supply actually be developed.

Walla Walla, Washington.—We now have under design a sewage treatment plant at Walla Walla, Washington, comprising settling tanks, sprinkling filters, separate sludge digestion tanks and contact tanks for chlorination. The effluent from this sewage plant will not enter a stream to be used for water supply but will be used for irrigating truck gardens. While this is not a situation directly relating to water supply, it nevertheless relates to the possible pollution of food supplies.

New York City.—Some years ago my partner, Mr. Greeley, designed a sewage disposal plant for the Board of Water Supply of New York City to treat the sewage of Mt. Kisco before its discharge into one of the reservoirs of the Catskill water supply. This village has a population of about 3,000. The treatment comprises sedimentation, contact filters, sand filters and chlorination. This plant also is operated by the Water Department.

Summary.—It seems desirable at this time to emphasize again the need for considering stream pollution factors with reference to the water supply problem. In all the varied uses to which streams may be put, there is none more important than that of water supply. When sewage treatment works are being projected, the use of the stream for water supply either in the present or future should be carefully reviewed and the sewage treatment works should be designed with reference to such considerations. Perhaps complete treatment works may not be required until some future time but considerations of area and head should be covered in the design.

River Sewage Control in Minnesota.—Use of navigable streams or lakes as sewage disposal areas is prohibited in a bill introduced Jan. 31 in the house of representatives of Minnesota. Any person, firm or corporation wishing to dispose of refuse into streams or lakes first must obtain a license from the state board of health, the bill provides. "Any person, firm or corporation which empties such substance into the waters of a navigable lake or stream at the time of the passage of this act, by means of sewer connection with such lake or stream or otherwise, shall be deemed to do so because the public health requires it, and shall be granted a license to continue to do so to the extent and in the manner then practiced, but not otherwise, and only for the period of time hereinafter provided and subject to any future amendment of this statute," the bill reads in part. The state board of health is also given authority under the provisions of the bill to adopt such regulations necessary for an efficient administration of the act, including the fixing of license fees to cover costs of administration.